AIRCRAFT YEAR BOOK

1920

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ISSUED BY

MANUFACTURERS AIRCRAFT ASSOCIATION, INC.

1920

Dominion — Over Earth, Ocean, Air

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MANUFACTURERS
AIRCRAFT
ASSOCIATION
INC.

[redacted]

DEDICATION

For I dipt into the future, far as human eye could see,
Saw the Vision of the world, and all the wonder that
 would be;
Saw the heavens fill with commerce; argosies of magic
 sails.
Pilots of the purple twilight, dropping down with costly
 bales . . .

— TENNYSON " Locksley Hall "

[redacted]

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[redacted]

INTRODUCTION

THE Manufacturers Aircraft Association presents the Aircraft Year Book for 1920, the second of the series.

In compiling this volume, the Association has enjoyed the cordial cooperation of the Army, Navy, and the Post Office air service. Appreciation is due especially to Lieut. Col. H. M. Hickam, Chief of the Information Group of the Army Air Service, Major Ernest L. Jones, also of the Information Group; to Lieut. Commander R. E. Byrd, and Lieut. L. B. Averill, of Naval Aviation; and to Otto Praeger, Second Assistant Postmaster General.

The Manufacturers Aircraft Association believes that the American public realizes the fact that we, the pioneers in aviation, must, and will lead the world. Prior to our entrance into the war, the art was neglected; the few months of the conflict were taken up with an industrial effort, without parallel in the history of the United State [redacted]

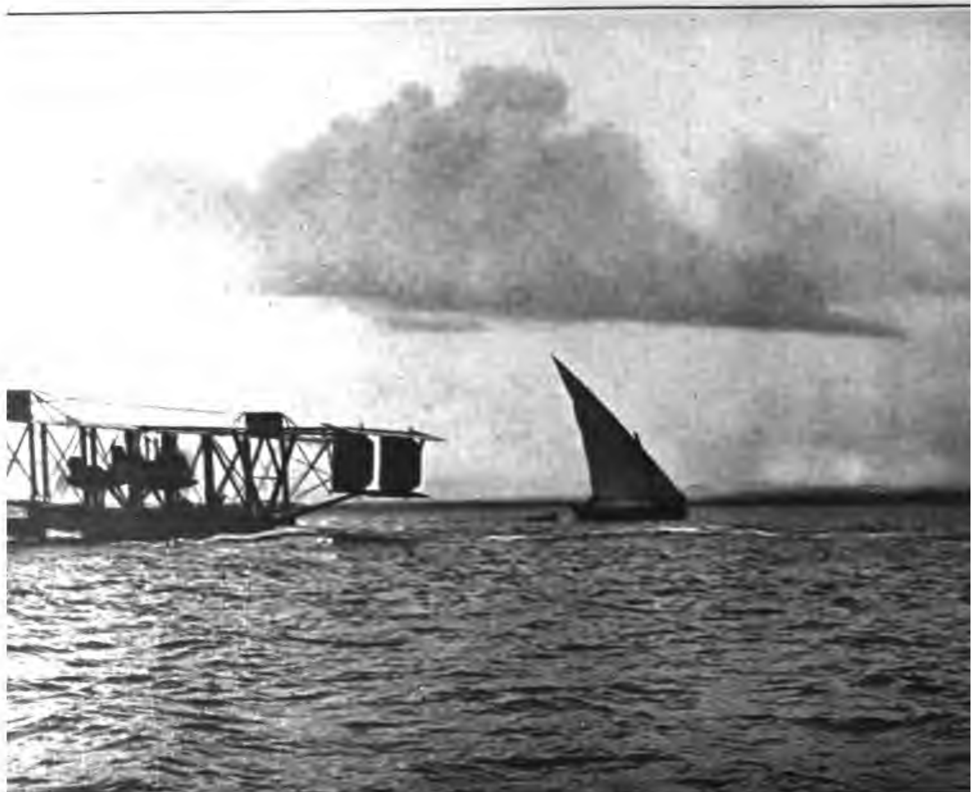
AIRCRAFT IN COMMERCE

SINCE the signing of the Armistice, November 11th, 1918, when the science of aeronautics was released from war, and permitted to demonstrate its possibilities in peace, the earth has been two-thirds flown around.

The Atlantic Ocean has been safely crossed four times, twice in heavier-than-air machines, and twice in lighter-than-air craft, and to America — the discoverer of the airplane — has gone the matchless honor of first achieving this feat.

Many thousands of persons — men, women and children — have been carried as passengers, for there is hardly a country one can think of, not even excepting China and the new Arabian kingdom of Hedjas, in which civil aerial transport has not been attempted to some degree.

As certain years, such as those which produced the first practical proof of some new progress by man, have passed into history as the opening of a new era, so the year 1919 will be recorded as the be- [redacted]



New. The N.C.-4 in Portuguese Waters.— Courtesy Naval Aviation Photography

ping, could well be protected by aircraft, was the declaration, and late in 1919 the first airplane left Hazelhurst Field, Mineola, Long Island, for the first patrol down the Atlantic shore.

The miner in remote regions, the oil operator plagued by bandits, the rancher perplexed by the failure of motor or horse transport,— these, we said a year ago, would have legitimate uses for aircraft. To-day, planes are carrying oil field payrolls, enabling executives to cover tremendous distances daily, and capitalists have called airplane manufacturers to their assistance in taking machinery to a rich but hitherto inaccessible gold mine, then removing the ore to tidewater.

Most stimulating of all were the forecasts — visions, some said — of a trans-Atlantic flight. " My first impression," said Lieut. Commander A. C. Read, of the N.C.-4, " on reaching Lisbon, was that the Atlantic Ocean had shrunk tremendously in size."

And so indeed it had, as had also the world — and man's conception of them. Kipling, many years ago, in his classic " The Night Mail," described the flight between suns from England to Canada, [redacted]

lane view of the Capitol, Washington, D. C. (Courtesy U. S. Air Service.)

the industry was hard pressed, and the improvement of types was gravely delayed.

That we are demonstrating the practicability of aerial transport, is due to the courage and the patience, the vision and the persistence of the men who designed and built and flew the craft which have startled and inspired America.

PRESENT AND PROBABLE USES OF AIRCRAFT

To enable the reader to visualize the impressive scope of aerial transport, there is offered the following tabulation of present and probable uses of aircraft:

- **Passenger and Freight Service.......**
  - "Hops" at fairs, expositions, and carnivals.
  - Commuting, intercity travel.
  - Overtaking steamers and trains.
  - Aerial ferries.
  - Competition with rail and water transportation lines, increasing as time, value and facilities govern and as aircraft develop in providing economical and regular service.
  - Establishing new means of communication with regions hitherto inaccessible or neglected by rail and steam lines.
- **Pleasure and Sport.......**
  - Pleasure
    - Touring: In private ships; in chartered liners.
  - Sport
    - Flying to golf, baseball, football, polo, etc.
    - Establishment of new records.
    - Aerial combat for points.
    - Exhibition flying.
    - Racing.
    - Amateur photography.
    - Flying to hunting and fishing grounds.
    - Hunting and fishing in aircraft.

See America First—From an Airplane! The Continental Divide.

(Demonstrating general utility in business.) . . .
- Selling goods.
- Quick deliveries.
- News and photographic services.
- Circulation of publications.

Extension of Personal Supervision by Executives
- Interurban
  - Competing with rail and water and being chosen for speed or certainty.
- Rural
  - Farms.
  - Ranches.
  - Oil Properties.
  - Mining.

- Exploitation of urban and rural real estate.
- City planning and improvement, terminal problems, parks, etc.
- Surveys and railroad routes.

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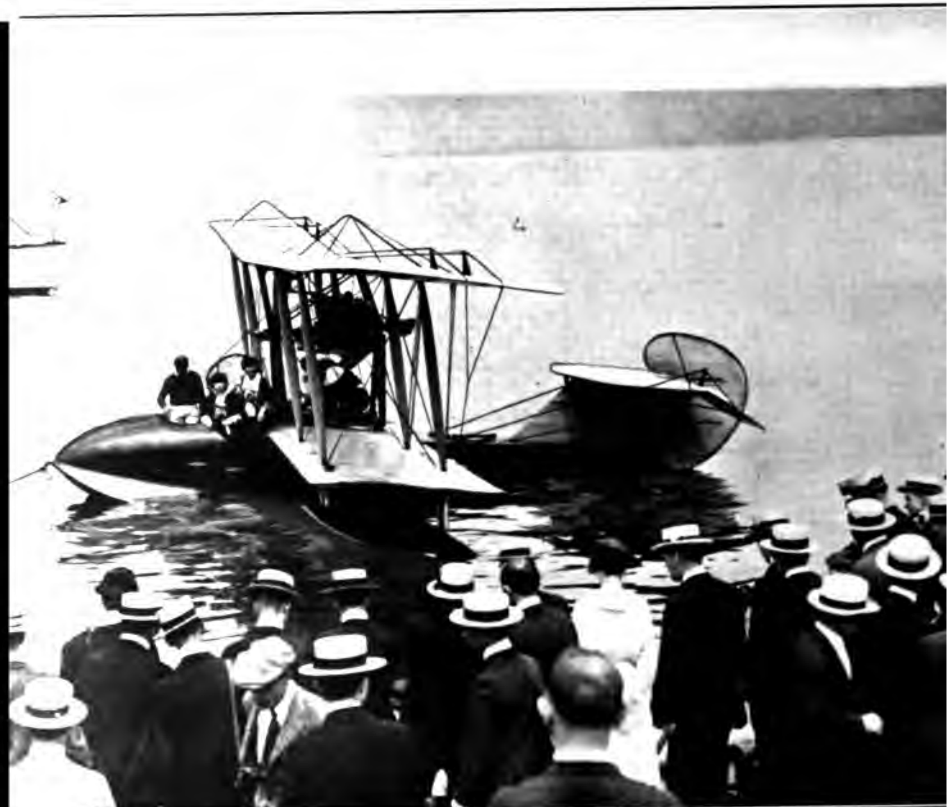


g Limousine. First passenger service between New York and Atlantic City, Summer, 1919
(Photo U. and U.)

Customs Service

State Constabulary...... { Quick movement of guards and troops and patrols for law and order.

Coast Patrol............ { Rescues. Locating submerged wrecks. Lighthouse tender service.

Mapping (General)
Fisheries Research
River and Harbor Projects
Forest and Field Photography for Isolating Infected Timber or Crop Areas.
Coast and Geodetic Survey

[redacted]

Dayton Wright O.W. Aerial Coupe

muting a prediction of the time when cities shall be released from the confines now imposed upon them by inadequate rail transportation. Whereas 17 to 20 miles is the comfortable suburban distance by train at present, the aero commuter does his day's work and — granted the establishment of proper terminals — is a hundred miles in the country an hour or so later.

There has been much commuting and inter-city travel, trips being made with increasing frequency between such points as New York and Washington, New York and Buffalo, Cleveland and Dayton, Cleveland and Chicago and on the Pacific Coast between San Francisco and Los Angeles, and between Portland and Seattle.

Notable flights have been made by civilian aircraft such as the first regular passenger service in Aeromarine flying boats between New York and Atlantic City; the trip which Mrs. S. E. J. Cox made in her Curtiss Oriole from Houston to New York, the frequent trips by Dayton-Wright De Havilands out of Dayton and the Thomas-Morse two-seaters out of Ithaca. The Curtiss Eagle and the Glenn L. Martin army transport, the one seating eight and the other [redacted]

Eight-Passenger Inter-City Liner. The Curtiss Eagle

than in the United States, airplanes are already being widely used for the transportation of passengers and a certain type of goods. In the latter category are included goods relatively light in weight and costly in value where rapid transit is a factor of importance and food supplies which are perishable and highly marketable at certain seasons. As a specific instance a daily passenger service has been operating with marked success between Paris and London since the summer of 1919.

As has been said above, it is the time element which plays an important rôle in aerial transport, that makes this method of travel more desirable for routes of 200 miles and over than any other means of conveyance. At the present stage of aeronautical development the commercial speed of a well designed transport airplane can be taken to average from 85 to 90 miles an hour. This is the speed which an airplane can be counted upon to furnish on the average daily run regardless of adverse weather conditions.

A cruising speed of 90 miles an hour means that the aerial pas- [redacted]

The Thomas-Morse Sport Plane over Cayuga Lake.

On the other hand, a system of premiums has been devised to enable air transport companies to face adequately the initial outlay of their services. These premiums will be paid in proportion to the service rendered (number of passengers carried over a minimum distance) and with regard to the rapid adaptability of commercial aircraft to warfare. A regular passenger service already operates between France and Morocco, and it is expected that before the end of 1920 a similar service will exist between Great Britain and India and possibly Australia.

In this country the transcontinental reliability race organized by the Army Air Service was a pioneering achievement of considerable value and served to point out with great forcefulness the utter lack of airdromes in all sections of the United States. A 32-hour passenger airline from New York to San Francisco is entirely feasible to-day with the machines now built. But the operation of such a line is not possible to-day owing to the lack of suitable landing, housing and supply facilities. When this situation will have been remedied nothing will stand in the way of the linking of our principal

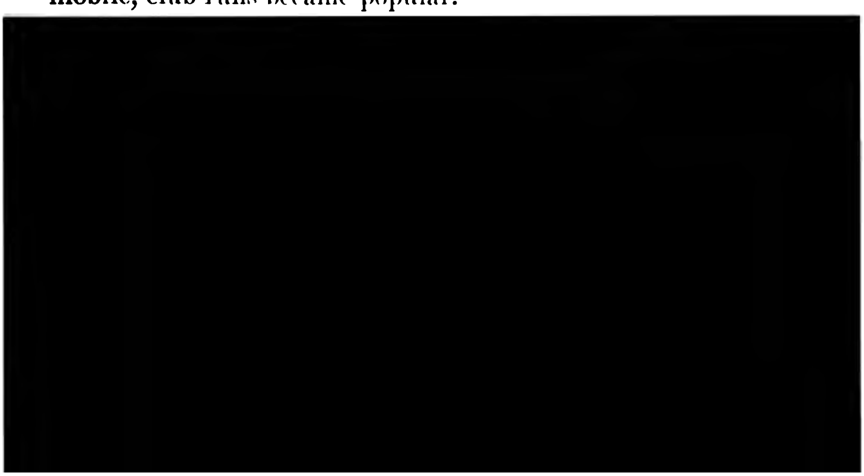
[redacted]

[redacted]

the confidence which the public is placing in the airplane as a sporting vehicle.

Nor is flying destined to be limited to the rich. Estimates on the cost of operating a typical land or water machine compare favorably with high class and high speed motor cars and motor boats.

During the season of 1919, football games were attended by several parties in flying machines, while seaplanes made trips along the Atlantic Coast to various sporting events. These were prophetic of the time when the polo field will be surrounded by parked single and two-place tractors, flown from long distances by their sportsmen owners. Upon the conclusion of the game they will take off, one by one, from between the lines, for whatever refreshments that replace the cocktail hour. Shark-shooting and duck-hunting, if no law intervenes, will be done from water machines. Aerial clay pigeon shoots will be more stimulating than of old. This year's cup races will be viewed from aloft and the newspapers will carry air pictures of the events. There is now nothing novel in flying in groups, so we may expect sociable tours, just as, in the early days of the automobile, club runs became popular.



eeing Horizon." The Aerial Express passes over the more leisurely dirigible

International airship races will come into vogue and rival motor track racing. These will be in classes, the same as motor racing is divided into groups in accordance with cubic displacement, or as yachts are rated, by length. There has been no airship racing since 1909, but foreign governments, late in 1919, were planning competition calculated to stimulate the flying game, not only from the sporting point of view, but for the development of lighter-than-air craft. Airplane racing is definitely established in popular favor.

One obstacle, inadequate landing facilities, which stood in the way of the normal development of sporting aircraft, is being removed. Fortunate is he who has sufficient room on his country estate to construct a hangar and lay out a landing field, or who has a body of water near his home, upon which his flying boat may alight. Realizing both the need and the insistent demand, cities throughout the United States are preparing municipal air harbors for public use. In many places, provision is made for the shelter of land and water aircraft and it is planned to offer maintenance facilities wherever possible.

[redacted]

The Glenn L. Martin Mail Plane

Long distance touring, after-dinner spins, morning bracers, will come into vogue. Aircraft for golf, tennis, polo and the games, friendly brushes over the river; flying to the hunt — aircraft offer comfortable pleasure, exhilaration, speed, limited only by the ever-fleeing horizon.

ADVERTISING AND PUBLICITY

Does business believe in advertising?

Does it believe in advertising when such publicity can be combined with selling goods or making quick deliveries? The answer has as its corollary the use of the airplane, as clothing, chewing gum, spark plug, typewriter and fountain pen manufacturers and department stores have proven to their satisfaction. In repeated Curtiss and Aeromarine flights, notably one which the Aeromarine made to Cuba and the Curtiss to New York from Buffalo, the utility of aircraft in advertising and publicity opening the way to general business uses has been demonstrated.

Commercial photography is another of the general business uses to which aircraft are being put. Aerial photography as a whole, in-

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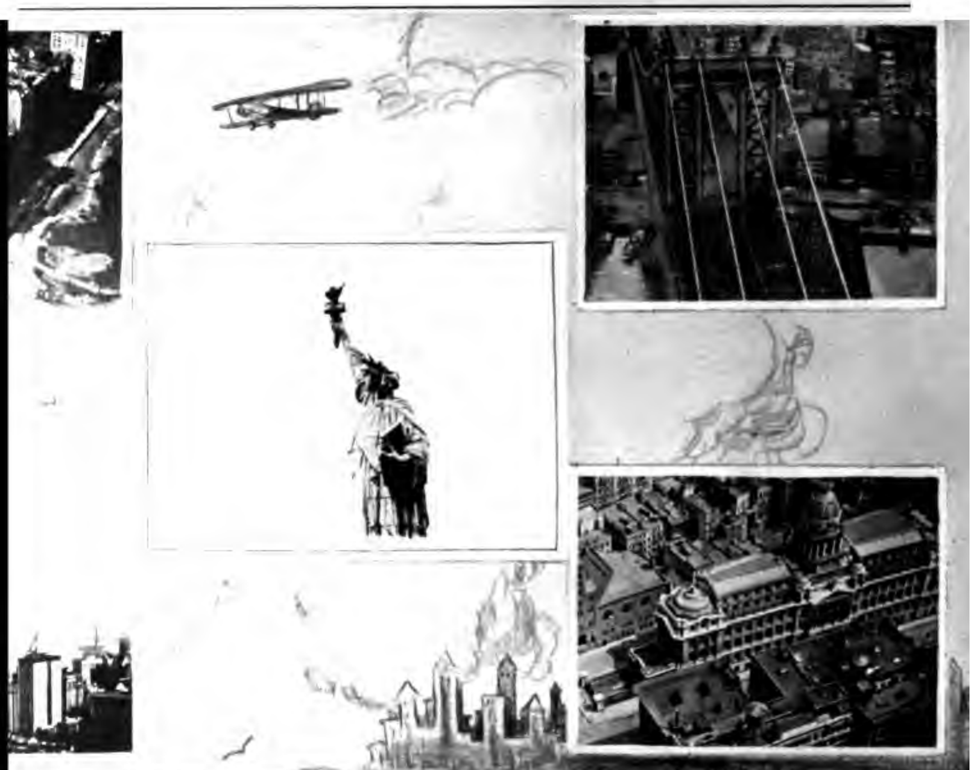


1. Plaza Hotel, New York City. 2. Manhattan Bridge as seen from the air. 3. Detail Ae
rty. 4. New York City Sky Line photographed from the air. 5. Airplane view of New Y
urtesy U. S. Air Service.)

In executive work in rural communities, the airplane has already become established. Sales in considerable number have been made to owners of great farms and ranches, and to oil and mining operators.

Among the miscellaneous uses to which business is placing aircraft may be mentioned the exploitation of real estate. A New York firm had a client who wished to build a hotel, but was uncertain as to the location proposed. How would it look when set in surroundings of which he had seen but little, and that from the street or a near-by roof? So the firm employed a commercial aerial photographer, and the trick was done.

Great construction projects are being watched from the air, city improvements are being planned and fire and police patrols carried out. The aerial ambulance has been demonstrated in the Army and in civil practise and in at least one notable instance — at Corpus Christi, Texas — airplanes have been used for flood rescue work.

AERIAL MAIL SERVICE

The Aerial Mail Service of the U. S. Post Office Department has been in operation daily, except Sunday, between New York and

[redacted]

...ed D. H. Mail Plane. How army equipment has been transformed for commercial uses

interest, and, within six months, was sought by representative cities in many parts of the United States. There is no doubt that the Aerial Mail took a major part in awakening the consciousness of America to the fact that commercial aeronautics "had arrived," and was disputing the monopoly hitherto held by rail, road and water transportation. On May 15th, 1919, the Aerial Mail was established between Chicago and Cleveland and on July 1st, 1919, the route between Cleveland and New York was opened. As this book goes to press, Congress is considering a $3,000,000 appropriation for the fiscal year commencing July 1st, 1920, which will permit the operation of one round trip daily by the Aerial Mail between the following points:

New York — San Francisco.
Pittsburg — St. Louis — Kansas City.
Boston — New York.
Washington — Atlanta.

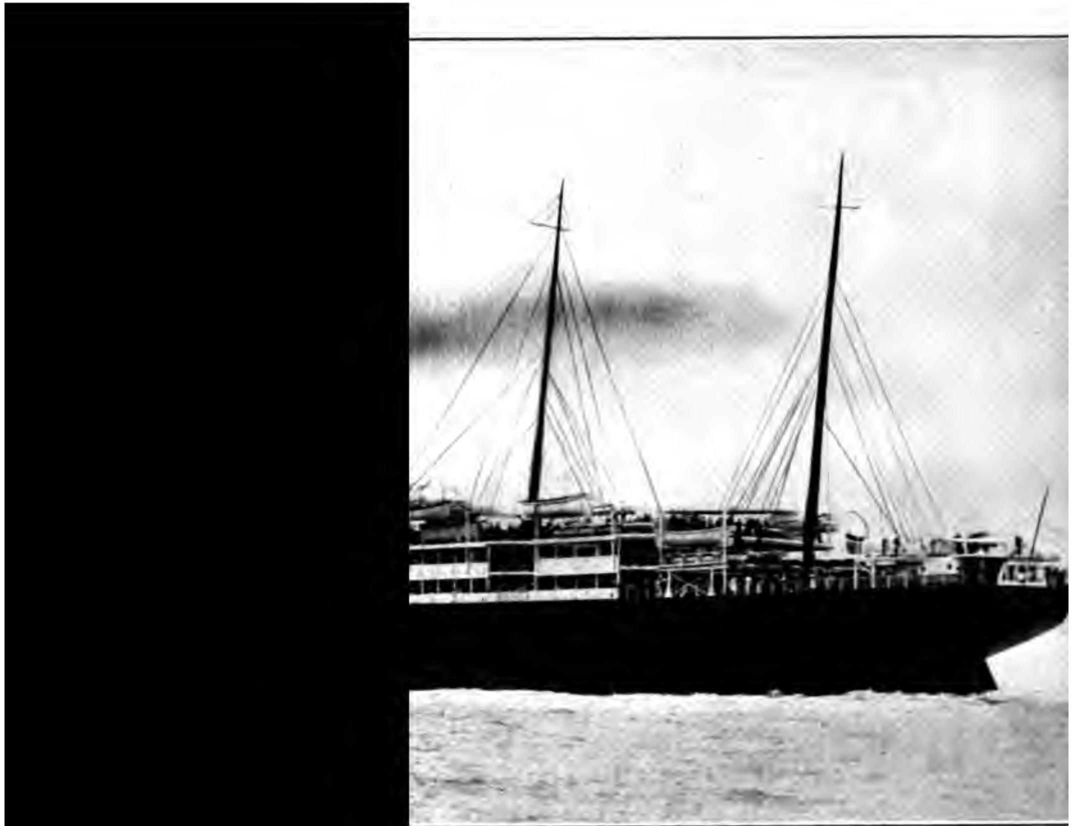
Thus the continent will be spanned from East to West, and from North to South.

The Aerial Mail Service thereupon set about transforming the war machine. Its aeronautical engineers, cooperating with the staff of the L. W. F. Engineering Company, developed changes which resulted in a comparatively satisfactory plane. A much stronger landing gear was substituted, the fuselage was strengthened and the cockpit and cargo compartments were re-arranged. It was this rebuilt "ship" that enabled the Aerial Mail Service to evolve the longer and more hazardous New York-Chicago service out of the Washington-New York laboratory run.

On May 15th, 1919, the anniversary of the establishment of the New York-Washington line and the opening day of the route between Chicago and Cleveland, the public was invited to witness the flight of the mail planes at Belmont Park, New York, and College Park, Washington.

The two airplanes that took to the air on this anniversary, one leaving Washington and one leaving New York, were Curtiss-Hispanos, the same that carried the mail a year before and had been constantly in the service pulled by the same motors. One of these had been in the air 164 hours, flying 10,716 miles, and had carried 572,826 letters. It had cost, in service, per hour, \$65.80. Repairs cost \$480. The other plane had been in the air 222 hours, flying 15,018 miles, and had carried 485,120 letters. It cost in service, per hour, \$18.34. Repairs to this machine cost \$1,874.76.

In addition to the six planes with which the service was opened, and which were in operation on June 30th, 1919, there were 42 planes in service on the two routes in operation on that date, namely, between Washington and New York and Cleveland and Chicago — 48 in all. On December 1st there were 90 planes in service.



rhauls S. S. *Adriatic* and drops pouch on deck, August 14, 191
l Photo)

exchange of mail was made at Philadelphia each trip. By this service mail between New York and Washington was advanced 2 and ½ to 3 hours over train service. In addition to airplane mail there is despatched daily from Washington to New York letter mail from southern points, connection made up to carrier districts in New York, which mail is delivered in New York the same afternoon instead of the following morning. On July 19th, 1919, the stop at Philadelphia was discontinued, and by changing types of planes the flying time has been reduced 30 minutes in each direction.

NEW YORK-CHICAGO ROUTE

The Aerial Mail between Chicago and Cleveland, begun May 15th, 1919, advanced the carrier delivery of letters at Cleveland and Boston by 16 hours and at Albany, New York and Springfield, Massachusetts, 6 hours.

Mail from San Francisco and the entire Pacific Coast states, from South Dakota and Northern Illinois, from Northern Minnesota and Northern Wisconsin, from North Dakota and Montana and from Kansas City and the entire Southwest, put on certain trains, reached Chicago in time to make connection with the Aerial Mail east bound. The Aerial Mail from these trains is taken direct to the Aerial Mail field. Under this arrangement, this mail is delivered in Cleveland and Boston on afternoon deliveries instead of the following morning. At Albany, New York City and Springfield, Massachusetts, this mail catches morning delivery instead of the after-

minals. Then came an interesting and highly significant experiment, conducted with the cooperation of the International Mercantile Marine, Operators of the White Star Line, and the Aeromarine Plane and Motor Company.

The experiment consisted in dropping a mail bag from a flying boat onto the deck of a liner at sea to expedite the movement of overseas mail which arrives too late to be delivered on board outgoing

several steamship lines to take aircraft into consideration in their plans for the future. It undoubtedly hastened the decision to establish United States-Cuba air service, because of the attention that was attracted to aerial transport over the sea.

A CANADIAN EXPERIMENT

The Canadian Government is desirous of promoting the Aerial Mail.

To W. E. Boeing, President of the Boeing Airplane Company of Seattle, goes the distinction of having first carried international mail in North America. On March 3rd, 1919, Mr. Boeing, in one of his seaplanes, accompanied by Edward Hubbard, assistant pilot, flew from Vancouver, British Columbia, to Seattle, a distance of 200 miles, with a bag of letter mail. The trip was authorized by the Canadian Post Office and the bag was officially received in Seattle, by the mayor of that city.

As a result of this flight, mail contractors in Alaska are investigating the possibilities of using the airplane instead of the dog sled.

While oceanic mails were being planned, it became evident that [redacted]

MONTREAL
BOSTON
MILWAUKEE
CLEVELAND
NEW YORK
CHICAGO
PITTSBURGH
PHILADELPHIA
CINCINNATI
WASHINGTON
ATLANTA
NEW ORLEANS

four thousand feet within the proximity of the field. As elevated antenna systems are manifestly dangerous to air navigation, the Aerial Mail Service experimented extensively in radio transmission and perfected an antenna only 20 feet high, highly directional and admitting of sharp tuning with remarkable transmission results. The installation of high powered stations in the vicinity of flying fields is, therefore, made possible. Efforts are being made to provide and perfect a practical visual signal which will take the place of the present audible signal. This will greatly enlarge the field of operation.

Complete telegraphic communication will shortly be installed, together with triangulation stations, which will allow the utilization of a complete despatching system whose main function will make it possible for distant points to locate planes accurately at any moment during flight. Distant controls are also being developed in order that the Department at Washington may get in communication with any pilot in flight by means of radio telephone.

Another contribution to aviation is now being worked out with ex-

ing May 14th, 1919, with a record of 92 per cent. gales of exceptional violence — from 40 to 68 miles an hour — and heavy snow storms being encountered and overcome. Out of 1,261 possible trips, 1,206 were undertaken, and only 55 were defaulted on account of weather conditions. During rain, fog, snow, gales and electrical storms, 435 trips were made. Out of a possible 138,092 miles, 128,037 miles were flown. Only 51 forced landings were made on account of weather and 37 on account of motor trouble.

Pilot J. M. Miller, who was formerly a naval flier, made the flight from Philadelphia to New York in a Curtiss R-4 with a 400 horsepower Liberty motor, rising from the field against a 43-mile gale and arriving in New York through a blinding snow storm with a wind velocity reported by the weather bureau to be 68 miles an hour and which was 15 per cent. greater at the altitude at which he flew.

One of the lessons learned from the operation of the Aerial Mail during the year, is that the element of danger that exists in the training of aviators in military and exhibition flying is almost en-

[redacted]

covered 174,261,393 acres, have a total estimated value of roughly $665,000,000.

During 1919 approximately 2,900,000 acres of National Forest lands were destroyed by fire; the damage represented a net loss of $4,500,000, and a cost to the Forest Service of fighting fires of about $3,000,000.

From 1915 to 1919 inclusive fires reduced the area of National Forest lands by 4,196,393 acres, causing a damage of over $7,000,000, to which must be added some $12,000,000 spent in fighting the fires.

It may be seen that fire is gradually felling our wood lands. The burning of approximately 7,000,000 acres of timber during the last five years constituted not only an immediate loss of lives and property, but also menaced the future of the great agricultural and other habitable regions as well.

The Department of Agriculture, through its Bureau of Forestry, endeavored for years to conserve standing timber. It was realized that the denudation of the great water-sheds in the West, permitting erosion and general desolation, would in time, carry ruin to the rich and fertile valleys. Reforestation, so long neglected, could not of itself offset the increasing yearly toll by fire.

The forest ranger was for years the sole, frail barrier between conflagration and American forests. His picturesque figure, afoot or on horseback, was traced over mountain trails. His vision was limited to natural vantage points. Moving slowly, he was unable even to report a fire until it had gained headway. In fighting the flames he was handicapped by his inability to view the menaced territory and station his forces accordingly. The increasing losses [redacted]

rest Fire Patrol flying over California Canyon
y Forest Service)

as absolute protection for life and property in the great timber reaches of the Cascades and the Sierra.

The tests by the Government have convinced the private lumber companies that they, too, must have similar service. In Oregon it is understood that they cooperate with the State in bearing expense incident to the patrol. No one more than the lumberman realizes so keenly the limitations of transportation. He spends days on horseback going to and from the railroad centers. Time is an important element in his work. Here, as in the cities, "time means money." What thing more natural, therefore, than for him to combine his private fire patrol with private transportation? Thus journeys of many days in the old way are reduced to hours in the new.

The aerial forest patrol presents an impressive contrast between generations. The ranger is bound to the earth; the aviator soars above it. At best the ranger's horizon is a few miles; the aviator is lord of a vast domain, yet both are typically American.

In the airplane sit pilot and observer. The pilot follows his set course; the observer, with his glasses and map, scans the landscape. After a few weeks he becomes so skilful that he can spot a fire thirty miles or more distant, determining, not only the location, but classifying it as to degree and possible cause. Traveling at an average speed of a mile and a half a minute, the observer must look and think

[redacted]

chute proving unsatisfactory, the wireless telegraph was installed.

In three months and seven days the patrol which operated over the Cleveland National Forest in California covered 46,297 miles in 466 hours and 56 minutes of flying time.

Seventy-five dangerous fires were discovered, and all this by an average of three planes in use daily.

An average of two planes daily covered 36,854 miles out of Rockwell Field, San Diego, California, in the same period of time, discovering 24 dangerous fires in the 410 hours of flying time.

Meanwhile, the training planes were superseded by American built De Haviland 4 planes which had greater climbing ability and could cover greater areas by reason of their higher speed and larger fuel capacity.

On September 8th, 1919, the two patrols were consolidated along with that from Mather Field, Sacramento, California, which since June 1st had patrolled 31,128 miles of territory and discovered 85 fires. From September 3rd until October 31st, 1919, the two planes from Mather Field discovered 70 fires. Other patrols operated from Fresno and Red Bluff, California, and it is planned to establish ad-

There was only one fatality on all these patrols, and only eight accidents involving major repairs to airplanes. It is this efficiency of the flying machine that has aroused enthusiasm in the heretofore flame swept areas of the far West.

The airplane forest patrol is said to have had a peculiar disciplinary influence on campers. Instances have been known where persons who had carelessly set fires to the undergrowth, hurried to a telephone and informed the forest supervisor of a fire, immediately on the approach of an airplane overhead.

The cost of operating the patrol is slight. The saving it effects is enormous. Plans are now under way for its extension throughout the Northwest.

PEACE TIME USES OF AERIAL PHOTOGRAPHY

One of the most important and interesting aeronautical developments which the World War brought about is aerial photography. The vertical aerial photograph, made from a high altitude, resembles

[redacted]

pect that it could not be duplicated. The former method requires days and weeks; the latter, hours and minutes.

A complete aerial photographic survey of the United States could be accomplished in a few years at considerably less expense than would be entailed by a ground survey; whereas at the present rate of progress by ground surveying it will take one hundred years to complete such a survey. Such an aerial survey would be one of the most useful of army peace time training activities.

This type of map, although on the whole theoretically less accurate than the present government survey map, is usually on such a large scale that when reduced to usable size the percentage error, while still in existence, is unmeasurable.

Instrumental problems are being gradually solved and within the near future, it will be possible to carry out a complete topographical survey by means of aerial photography with a minimum of ground control.

Accuracy equal to that now obtaining in the majority of maps published has already been accomplished regularly and it is felt that with proper equipment and experiment, the accuracy of the most minute maps now published can be obtained.

MUNICIPAL AND BUSINESS USES

It is difficult to list fully the applications that can be made of aerial photography in peaceful pursuits, because this branch of photography is so new and its range of usefulness so extensive that almost daily some one thinks of another field in which it can be employed.

For city planning, reclamation, forestry, and many other uses aerial photographic surveying is beyond approach by any other existing method and will undoubtedly come into common use within the

should turn to photography from the air for securing photographs of their cities; to show railroad lines, harbor facilities, well-arranged streets for hauling manufactured products, residential sections for workmen's homes, factory districts, groups of large business buildings and for other purposes.

Photographs of the same city, taken at intervals of a few months or years, would illustrate more eloquently than an array of charts the statistics as to its growth. Fire insurance companies will inevitably become interested in these aerial surveys as they would in fact be inspections from the air that would give the companies a bird's-eye view of the conditions and surroundings of buildings in various sections of the city and thus enable them to realize and keep check on the fire risk involved.

The progress made in the construction of engineering projects, such as buildings, canals, railways, as well as the comparative merits of various types of city planning, can be better shown by aerial photographs than by any other means.

[redacted] "Round Manhattan Flight." (Courtesy of Photo Section A. S., Hazelhurst Field, Mineo

given point. Furthermore, aircraft are able to reach a level beyond the belt of dust which surrounds the earth and hinders vision. Progress in power plant accessories will soon enable the attainment of altitudes far beyond the six mile limit of yesterday's airplane. The sounding of the upper air, which has been going on for many years by every meteorological station in the world under international cooperation using kites and small sounding balloons, will now be possible with human observers, reaching definitely known altitudes over definite locations.

Exploration of unknown lands at well nigh inaccessible spots opens up further possibilities of trade and scientific study, as a result of which new flora and fauna may be added to the world's collection.

AIRCRAFT AND FISHERIES RESEARCH

Aerial observation over any given territory in which fisheries research work is to be carried on gives the investigator an excellent idea of the character and extent of the region, much more vivid and detailed than any that could be obtained by charts, descriptions, or ordinary means of inspection. It places the natural features of the [redacted]

craft, as one wishes. Only a little sacrifice of speed to carry one's friends,— just as with your motor car. There is no more guess work or cut-and-try, to their construction, than there is to the building of a bridge.

increase in the number of landing fields, their flying range will extend. Progress is the fundamental law in aeronautics. Competition is a stimulant. And just as this Aircraft Year Book for 1920 justifies what was said in the preceding volume, so greater confidence may now be expressed in the general use of aircraft to the every day business of mankind.

The world has been two-thirds flown around. Continents have been crossed and oceans spanned. But the greatest body of water in the world, the Pacific Ocean, remains to be conquered, and in conclusion it may be forecast that before the passage of another year, America will be linked by air on the west with Asia, as she was on the east to Europe in the year just closed.

CHAPTER II

CROSS-COUNTRY FLYING AND LANDING FIELDS

THE comprehensive aircraft program which the Unit States Government was compelled to adopt in 1917 to satis one of the requirements of modern warfare, had as a cor lary the establishment of a fair number of land and water air static throughout the country

palities receive in return steel hangars from the Government. The maintenance of the air harbor is assumed by the municipalities.

This policy met with great favor in progressive communities, and many cities not comprised in the original Air Service program are now laying out air harbors to government specifications and in co-operation with the Air Service.

AIR-SERVICE SPECIFICATIONS FOR LANDING FIELDS

January 1st, 1920, the Air Service issued revised landing field specifications, which are as follows:

In the selection of landing fields at a city, special attention should be given to the following points:

1. *LOCATION:*
   - (a) The Field should be situated close to transportation facilities, both passenger and freight, and electric power and water supply should be available.
   - (b) An effort should be made to select a location in a place where the field is unlikely to be later surrounded by building operations.
   - (c) If the city is unable to provide for a field of the ideal size, if possible, a site should be selected which is capable of expansion to a larger

of small fields, as the presence of small fields en route are of vital importance, and as such, they will function as emergency fields for airplanes that need a great deal of room to take off and land, and as landing stations for small or slower planes. In the establishment of these fields, the general specifications should be followed in regards to shape, character of ground, approaches, obstacles, etc. Should there be obstacles around the field, the portion of the field available for use will be shortened by a distance depending upon the height of the obstacle. An obstacle 100 ft. high will make at least 700 ft. of the field unavailable for use. The length of the " Runway " available for use should be computed by subtracting seven times the height of the obstacle surrounding the field from the length of the field in the direction in which the " Runway " is being computed.

(b) Another factor which enters into the size of fields is the question of the surrounding country. Should a field be located in a locality where there are fields available for emergency landings immediately adjacent to the municipal landing field, the danger of accident due to failure of motor, immediately in the vicinity, will be much lessened and the need of the 1,000-yard " Runway " is not so urgent. Should the country surrounding the field, however, be covered with buildings, or be of such a character that it is impossible to land upon it with safety, the best interests of aviation demand that the field should be large enough to enable the pilot to circle the field in any type of machine, keeping always in such a position as to be able to return to the field in case of the failure of the motor.

(c) It would thus seem, that it is impossible to make a classification of landing fields according to size, which would show their relative suitability for aviation purposes and, accordingly, all classifications heretofore made are withdrawn.

(d) In addition it may be further noted that there are types of machines with which it is possible for the average pilot to land in a field, without chance of accidents, with much less than a 600-yd. " Runway." It is also possible, with *average luck,* for good pilots to land any present type of machine in fields of smaller dimensions than 500 yards.

3. *SHAPE:*

The best shape for a field is that of a square, but an " L " shaped field will suffice, providing each arm provides a satisfactory length of " Runway." It must be pointed out, however, that an " L " shaped field does not provide all the advantages for a return to the field in case of failure of motor, which are possessed by a square field.

4. *CHARACTER OF GROUND:*

The ground should be firm under all weather conditions. A light, porous soil with natural drainage is recommended as the most suitable. A field with clay soil invariably demands special drainage and is unsatisfactory as a rule during wet weather. It is possible, however, to lay a system of tiling which will drain any field after the hardest rain. The field should be covered with sod. The surface should be level and smooth, so that airplanes can normally land upon and taxi across without injury.

5. *APPROACHES:*

Surrounding obstacles, such as high buildings, high-tension power lines, trees, etc., limit the amount of field available for landing by the amount indicated above, and in addition provide an element of danger for the pilot in case of misadventure.

6. *MARKING:*

A white circle, 100 feet in diameter with a band 3 feet wide has proven by experience to be an excellent distinctive marking for a landing field. This can be seen at almost any attainable height with clear visibility. By digging out the earth to a depth of about six inches and filling in with crushed rock, a very substantial and economical marker can be made. It is necessary to keep the marking clear white to make it show up well. This can be done by white-washing from time to time. The name of the station should be marked in chalk letters 15 feet long by 3 feet wide. A wind indicator, such as the standard aviation wind cone, should be placed at one corner of the field 30 feet off the ground.

7. *ACCOMMODATIONS:*

Municipal landing fields should provide communication by telephone, transportation facilities, gasoline, oil and sundry supplies. Hangars, guards, and shop facilities will be needed in addition with the development of the use of the field

proof was given of the relationship which an air harbor within gliding distance bears to safe mechanical flight.

The winners of both the New York-Toronto and New York-San Francisco races agreed that the greatest need of aviation to-day is the establishment of adequate landing facilities, not only in the thickly populated areas, but along well defined routes across country, which are certain, in years to come, to be followed as commercial highways of the air.

The transcontinental airplane race demonstrated that aerial racing is of itself not nearly as dangerous, even where adequate landing fields are missing, as automobile racing on specially prepared tracks and with ample facilities for repairs and replacement. That this is true may be seen from the following table, in which the New York-Toronto and the transcontinental airplane races, the greatest aerial events of 1919 in the United States, are compared with the 500-mile race on the Indianapolis motor speedway.

AIR ROUTES OF THE WORLD

(Land flights in statute miles, sea flights in nautical.)

	One Way Miles	Round Trip Miles
UNITED STATES		
Transatlantic flight of N.C.-4	2925	
New York-Toronto Race	525	1042
Transcontinental Race	2701	5402
Rim Flight (Martin Bomber)		9823
San Diego-Washington	4000	8000
Keyport, N. J.-Havana (Aeromarine)	1421	2842
CANADA		
Lethbridge-Vancouver	600	
EUROPE		
London-Port Darwin, Australia	11500	
Transatlantic flight of R-34	3200	6400
Transatlantic flight of Vickers-Vimy	1936	

the United States have accepted aerial transportation as a factor of highest public utility.

But commercial air services cannot safely function if the country flown over does not offer to the aerial navigator a comprehensive chain of airdromes, that is, *permanent air harbors.* These must be properly laid out and marked to permit of safe landing; they must also be equipped with hangars, for sheltering airplanes in transit, and contain stores and repair facilities for emergencies.

An airdrome plays the same rôle in aerial navigation that the harbor plays in marine navigation. A level field merely permitting landings in case of *emergency,* no more deserves the name "airdrome" than an inlet or roadstead can be termed a harbor.

In comparison with the principal European nations, the United States sadly lacks airdromes. The list of airdromes and landing fields which is printed in the appendix shows that there are only 115 permanent airdromes in the United States and Dependencies, which number comprises 13 seaplane stations. This is to say that there is only one airdrome for every 26,300 square miles of continental area of the United States.

The spirit of civic progress, if not of common forethought, should urge every important community to have its municipal airdrome. At the date of writing only seventeen American cities have air-

[redacted]

INFORMATION SHEET ON LANDING FIELDS

(Use a separate sheet for each landing field reported on)

1. Name ....
2. Town and State ....
3. Local name of field ....
4. Shape and dimensions in feet ....
5. Direction of long axis ....
6. Direction of prevailing wind ....
7. Markers, if any ....
8. Contour of the field ....
9. Condition of surface and drainage ....
   ....
   ....
   State if wet weather landing possible ....
   ....
10. Obstruction in and around field, including fences, telegraph wires, trees, ditches, etc.; suitability for small airdrome.
    ....
    ....
    ....
11. Availability and quality of supplies, with name of firm supplying
    ....

[redacted]

PRINCIPAL LONG DISTANCE CROSS COUNTRY AIRPLANE, SEAPLANE AND DIRIGIBLE FLIGHTS IN THE UNITED STATES

Date	*Principal Cities on the Route*	*Approximate Statute Mileage*

July 11th, 1911 BOSTON–WASHINGTON 461

Harry N. Atwood **in a Burgess-Wright Biplane landed at College Park after flying from Boston, with stops at New London, Astoria, Governor's Island, New York City, Asbury Park, Sea Girt, Tuckerton, Atlantic City, Farnhurst, Stemmer's Run, College Park. Three days later he landed in the White House grounds for a call.**

August 26th, 1911 ST. LOUIS–NEW YORK WORLD'S CROSS COUNTRY DISTANCE RECORD 1155

Harry N. Atwood **in a Burgess-Wright Biplane won the Victor J. Evans prize of $10,000 for the St. Louis-New York trip to be done in 4 days. Route: St. Louis, Springfield, Pontiac, Chicago, Elkhart, Pettisville, Toledo, Venice, Sandusky, Cleveland, Swanville, Erie, Buffalo, Lyons, Auburn, Belle Isle, Fort Plain, Castleton, Garrison, Nyack, Governor's Island, New York City.**

October 21st, 1911 MINNEAPOLIS–ROCK ISLAND SEAPLANE MAIL FLIGHT 314

Hugh Robinson **in a Curtiss hydroairplane carried mail a record distance.**

November 5th, 1911 FIRST TRANSCONTINENTAL FLIGHT 3390

Calbraith P. Rodger **crossed from New York in a Wright Biplane to Binghamton, Akron, Dayton, Decatur, Chicago, Peoria, Springfield, Centralia, Kansas City, Vinita, Muskogee, Ft. Worth, Waco, San Antonio, Del Rio, El Paso, Tucson, Imperial Junction, Pasadena.**

February 17th, 1912 SECOND TRANSCONTINENTAL FLIGHT 2520

Robert G. Fowler **flew his Wright Biplane from Los Angeles, Pasadena, Yuma, Tucson, Douglas, El Paso, Sweetwater, Ft. Worth, Houston, Orange, New Iberia, New Orleans, Biloxi, Flomaton, Evergreen, Troy, Bainbridge, Quitman, Pablo Beach.**

December 15th, 1912 FIRST GREAT SEAPLANE FLIGHT 1500

Antony Jannus **flew his Benoist seaplane from Omaha, St. Louis, New Orleans.**

1918 1919 NEW YORK–WASHINGTON

Daily, except Sunday, trips of the Air Mail.

Begun May 15th, 1919 NEW YORK CHICAGO

Daily trips of the Air Mail: New York, Cleveland, Chicago.

1918–1919 SAN DIEGO WASHINGTON AND RETURN 7000

Major A. D. Smith's Squadron **of army airplanes flew from San Diego, Phoenix, Tucson, El Paso, Marfa, Del Rio, San Antonio, Houston, Baton Rouge, New Orleans, Mobile, Montgomery, Americus, Jacksonville, Daytona Arcadia, Daytona, Savannah, Raleigh, Petersburg to Washington. Returning to Petersburg, Raleigh, Pinehurst, Columbia, Fayette, West Point, Dallas, El Paso, Tucson, San Diego.**

March 12th, 1919 HAMPTON ROADS ROCKAWAY AND RETURN. NON-STOP BETWEEN POINTS

Navy H-16 **1 pilot, 5 passengers; *Navy F-5* 1 pilot, 4 passengers. Return trip made in 195 minutes, a distance of 300 [illegible]**

Toledo, Detroit, Cleveland, Pittsburgh, Buffalo, Syracuse, Albany, Concord, Portland, Boston, Providence, Hartford, Mineola.

Middle Western Flight. Similar flying was done at Houston, New Orleans, Jackson, Memphis, Little Rock, St. Louis, Springfield, Chicago, Milwaukee, Madison, Duluth, Minneapolis, St. Paul, Fargo, Aberdeen, Redfield, Sioux Falls, Sioux City, Omaha, Kansas City, Wichita, Tulsa, Oklahoma City, Muskogee, Fort Smith, Shreveport, Houston. 7747

Far Western Flight. These teams covered San Diego, Los Angeles, Fresno, San Francisco, Sacramento, Reno, Salt Lake City, Boise, Pocatello, Walla Walla, Portland, Tacoma, Seattle, Yakima, Spokane, Helena, Butte, Miles City, Sheridan, Alliance, Cheyenne, Denver, Pueblo, Trinidad, Albuquerque, El Paso, Tucson, Phoenix, San Diego. 6626

April 25th, 1919 HAMPTON ROADS—ENDURANCE FLIGHT 1437

Navy F.5-L, flying boat, flew a non-stop course. One pilot and 3 passengers. The duration was 20 hours, 10 minutes.

May 7th, 1919 WASHINGTON–MACON AND RETURN 1300

.... in a Martin Bomber with 3 other passengers from Washington, via Asheville, North Carolina, to Macon and return via Asheville, North Carolina. Duration, 14 hours, 10 minutes.

July 7th, 1919 SAN FRANCISCO–SAN DIEGO NON-STOP 610

Captain L. H. Smith in a D-H-4 made this non-stop flight in record time of 246.5 minutes.

July 11th, 1919 AKRON–LANGLEY FIELD 407

Army's Goodyear airship A-4.

August 22nd, 1919 BUFFALO–MINEOLA NON-STOP 440

J. D. Hill in Curtiss Oriole flew the distance in 4 hours, 10 minutes.

August 25th, 1919 NEW YORK–TORONTO RACE 1042

Contests between 32 military and civilian pilots who completed the course — Mineola, Albany, Syracuse, Buffalo, Toronto.

1919 AIR MAIL PATHFINDING TOUR 12

[redacted]

flown over almost every part of the United States in their quest for landing fields that would be available in cases of emergency. As a result of this survey work, valuable information has been gathered with respect to about 1,000 emergency fields. These as well as the permanent airdromes will be found in the appendix, arranged alphabetically under states. The letter, or group of letters, following each state name and the numbers following in parentheses indicate the state symbol and field numeral assigned to it by the Air Service. These symbols and numerals will be permanently and visibly displayed on all airdromes established in accordance with Air Service specifications. In addition to the cities shown in this list, numbers are being assigned by the Air Service to thousands of cities all over the United States, regardless of whether or not they are provided with a landing field. These numbers will appear on vacant lots, city roofs, parks and golf courses. Aviators will thus be enabled promptly to identify a city while passing over it even though the aviator may be unfamiliar with the territory.

IMPORTANCE OF THE WEATHER FORECAST

Weather conditions, present and prospective, are of direct concern to the aerial navigator. Though the airplane and the airship are largely independent of atmospheric disturbances and can, if necessary, disregard them in most cases, a pilot "forewarned is forearmed." On the other hand, the pilot wants to take the utmost advantage of favorable *conditions*, such as following winds.

The aerial navigator of the present is somewhat of a meteorologist himself. He knows what certain types of clouds mean, he knows how to read a weather map, is conversant with the general laws of weather changes and appreciates the value of forecasts and flight

In 1913 at the request of the Secretary of War, Dr. W.
Humphreys gave a course of lectures on meteorology in aeronaut

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In 1913 at the request of the Secretary of War, Dr. W. J. Humphreys gave a course of lectures on meteorology in aeronautics to classes in aviation at the Signal Corps School, San Diego. These lectures were subsequently expanded into a series of articles entitled "Physics of the Air," which were printed in the *Journal of the Franklin Institute.* An extended article, "Effects of Winds and Other Weather Conditions on the Flight of Airplanes," was published in the *Monthly Weather Review,* Weather Bureau, Washington, D. C., August, 1919, Vol. 47, pp. 523–532.

During the Army's cross-country flights between San Diego and Los Angeles in 1916 the local bureau provided forecasts and it continued so to do until meteorology became part of the ground school course for government pilots and this science became a recognized aid to flight.

During the World War, the Meteorological Section of the A. E. F. under Lieutenant-Colonel Blair furnished the Air Service and our armies, detailed forecasts for each succeeding 24 hours, with special forecasts at intervening periods. Information was circulated by radio as to the speed and direction of the wind at various altitudes, and utilized by the pilots in the various airplane operations.

[redacted]

of the radio direction finder, the pilot has become literally master of the elements.

Imagine a lighthouse with guiding rays surging through space in every direction over a radius of six hundred miles or more! Yet such a beacon is by no means a figment of imagination. It is the lighthouse of the immediate future, wherein electro-magnetic waves will take the place of searching beams of light, and safeguard navigators of the air. Its successful development is the outcome of one of the most remarkable scientific achievements of the war period and its universal use is one of the promises of commercial aviation.

What is the nature of this modern lighthouse? How does it work? How has it been developed? What we have termed a "lighthouse" is nothing but a high-power wireless telegraph station, which sends out electric signals arranged, like the rays of marine lighthouses, in alternate flashes of varying length.

It is in the reception of these signals on board aircraft that the function of direction finding exists, thus enabling the airdrome wireless station to act as a beacon. This invention constitutes one of the greatest tributes to the ingenuity and observation of man, and like so many other aeronautical inventions its rapid development is due to the concentration of many minds upon one idea during the

In this case the operation is as follows: Assume that a wireless lighthouse is erected at Mitchel Field, Long Island, and the machine is flying there from Buffalo. The lighthouse is sending out two short flashes every thirty seconds, the international signal that will designate Mitchel Field (assumed).

At the beginning of the flight the pilot will maneuver his ship until he hears this signal. Then throughout the remainder of the flight, he will keep these signals in his ears, knowing that so long as he hears them, his ship is pointed in a direct airline to Mitchel Field. He cannot get lost, no matter how bad the weather, because weather conditions have no serious effect upon the transmission of wireless waves. Even in fog he will proceed without hesitation toward his destination.

The other type is for larger aircraft, including airships. Though rather more complicated, it has a wider range of navigational possibilities. It consists of two coils, one rigid, and the other moving in a complete circle within it. The moveable coil is the "searcher," and its function is to search for a known wireless station.

Any aircraft equipped with such a finder is independent of an [redacted]

CHAPTER III

AIRCRAFT IN WARFARE

The Airplane in National Defense

Use of aircraft as a separate arm to attack all enemy air forces and his forces in land and sea.

Liaison with our own land forces by aerial units attached to them and under their control.

Liaison with our own sea forces by aerial units attached to them and under their control.

SOME DETAILED MILITARY AND NAVAL USES

Aerial messenger service.
Visual reconnaissance.
Artillery surveillance.
Artillery adjustment.
Communication between fleet commander and cooperating force on shore.
Adjustment of shore batteries.
Adjustment of fire from ships.
Bombardment raids

(Through the courtesy and cooperation of officers in the Air Services of the War and Navy Departments, the Manufacturers Aircraft Association is able to present the following discussion of the development of aircraft during the World War. It is believed that they include the first comprehensive account of the progress of combat in the air from 1914 to 1918, as followed by those who have in mind our future national security. The application of aircraft during the conflict had such astonishing consequences that its further development along even more remarkable military lines may be expected. In uniting the elements of destruction and transportation, the airplane introduced a situation comparable only to such a period as would have appeared had man, at the same moment, produced gun powder and the steam locomotive. The increased use of aircraft during the World War, leads to the conclusion — which to many appears inevitable — that a Separate Arm is necessary. Aircraft, traveling in three dimensions, immersed in the element in which they move, are not merely an adjunct to the land and sea forces — they form an independent weapon, destined to command the decision in any future war.— EDITOR.)

MILITARY AVIATION

THE science of military aeronautics is strictly a development of the World War. Although the Great Powers, with the exception of the United States and Japan, had organized [redacted]

porting however, led to such inefficiency that great efforts were made to improve transmission of reports. This resulted in the development of despatch bag dropping, visual signals (such as streamers, smoke bombs, Very lights, etc.) and finally airplane wireless.

The introduction of high-angle ordnance for fighting airplanes (anti-aircraft guns) forced the improvement of airplane performance in the matter of ceiling (attainable altitude) and maneuverability.

The requirements of aerial fighting soon determined the type of machine most adapted to this purpose, namely, the single-seater tractor. This type was so maneuverable that it became possible to discard complex gun mountings and to fit the machine gun rigidly to the fuselage. With this arrangement, the pilot only needed to aim the airplane, instead of the gun alone, against the enemy machine. The presence of a propeller in front of the gun proved a problem of great difficulty, but this was overcome by synchronizing the machine gun with the engine so that the firing mechanism would function only when the muzzle was not covered by the propeller blade.

2.— To attack enemy aircraft operating against our own or allied troops or air forces attached to the Army.

3.— To attack and harass enemy troops in the field and destroy his communications, stores and ammunition dumps.

As the type which was designed to perform the function under the first heading, we may place the "observation" airplanes, whose

bombers must necessarily be reliability of power plant, great lifting capacity and reasonably good speed. In the day bomber, ability to protect itself somewhat from enemy aircraft and in the night bomber effectual provision for accurate navigation regardless of adverse weather conditions.

Toward the end of the war, an additional function was assigned to the pursuit airplane, namely, the harassing of the enemy on the ground with machine gun fire. This ground attack work exerted a greatly demoralizing effect on the troops and its use became so general in the last year of the war that special defense patrols of airplanes had to be organized. On the other hand, the Allies as well as the Germans were ready to put into service, at the time of the Armistice, ground attack airplanes which carried a very complete armor plating around the vital parts for protection against machine gun fire. These were the machines referred to as " flying tanks."

Aerial observation, with its various subdivisions, retained up to the end of the war, its primary importance with regard to army operations and it has become an axiom that an army deprived of observation machines is simply blinded and at the mercy of the adversary. That the proper execution of this observation work required fighting machines for its protection is obvious, just as is the coordinate employment of bombers against targets of tactical importance.

with the organization of their "Aerial Division" which was c
posed of some 800 day bombardment and pursuit machines. T
unit formed the strategical reserve of the French Aviation and
used with telling effect in the major engagements of the latter p
of the war.

In regard to the coordinated employment of the various branche
military aviation in land battles, the plan of operations of the Uni
States Army Air Service in the battle of St. Mihiel affords an ex
ple of the most up-to-date nature.

The plan of operations of a modern battle provides for three
tinct phases of combat:

First, the preparation of the attack. Here, in order to ins
secrecy, the enemy must be prevented from carrying out reconn
sance flights over our lines, while we must find out all we can ab
him. This must be done, however, without showing unusual activ
else the enemy might suspect our preparation.

Second, the attack up to the objective assigned beforehand. H
the function of aviation is to destroy all hostile air forces encounte
after which ground troops are attacked. Beside this work, pro
cooperation must be insured with the infantry an
matter of observation and *liaison.*

Third, the exploit

Kite balloons, owing to their immobility and steadiness in high winds, usefully supplement the work of airplanes in artillery observation and local surveillance. On the Western front alone several hundred kite balloons were in daily use on each side of the lines. The value of these aerial observatories was so great that special pursuit units were assigned for their destruction with incendiary bullets. To guard against these attacks, balloons were protected by anti-aircraft guns, machine guns and special protective squadrons, and this system made it so difficult to burn enemy balloons that the American Air Service introduced the idea of night attacks. These met with great success, seventeen German balloons being shot down by one American officer alone within a week.

Since the Armistice, the Air Service has drawn up a plan for the use of small airships in the ranging of coast batteries and general observation work hitherto performed by kite balloons. With this end in view, the Army acquired in the late fall of 1919, four American made nonrigid airships of 100,000 cu. ft., and five foreign built ships of about 150,000 cu. ft.

AIR SERVICE STRENGTH

The Air Service of the United States Army originally came into being on July 18th, 1914, when the Aviation Section was created within the Signal Corps, with an allotted strength of 60 officers and 260 soldiers. Its equipment then consisted of six airplanes. The normal development of the Air Service — which was separated from the Signal Corps in 1918 — was retarded by inadequate appropriations until the United States declared war on Germany. On that day the personnel of the Aviation Section numbered only 65 officers and [redacted]

number 78,726 were overseas, distributed as follows: 58,828 in France, 19,724 in Great Britain and 174 in Italy.

American aviators flew for 35,747 hours over the enemy, covering a distance of 3,574,700 miles. Of the flights 12,830 were for pursuit, 6,672 were for observation and 1,174 were for bombing. In the latter work 275,000 pounds of explosive was dropped. The Air Service in France shot down altogether 776 airplanes and 72 balloons of the enemy and lost but 289 American aircraft — a ratio of superiority of more than two and two-thirds to one.

The present strength of the Army Air Service is limited by an Act of Congress to 1,923 officers and 21,853 men.

AIRPLANE AND BALLOON LOSSES DUE TO ENEMY ACTION

LOSSES	U. S.			ENEMY		
	PLANES	BALLOONS	TOTAL	PLANES	BALLOONS	TOTAL
1st Army	203	48	251	510	54	564
2nd Army	2	0	2	6	1	7
17th Sqdn. attached to RAF	19	0	19	51	3	54
148th Sqdn. attached to [redacted]						

four naval officers were trained as aviators and a few machines were purchased by the Navy for its newly created Aviation Section. From then on up to 1917, the principal efforts of Naval Aviation centered in the development of a seaplane which would couple a fair degree of seaworthiness with good flying qualities.

The invention, in 1912, of the flying boat and the development of a compressed air catapult for launching seaplanes from warships were the most notable achievements of this experimental period.

When the United States declared war on Germany in April, 1917, the Naval Air Service had a personnel of 38 officers and 163 men and one naval air station, at Pensacola, Florida. The aircraft in commission comprised 45 float seaplanes, 6 boat seaplanes, 3 land airplanes, 2 kite balloons and a small nonrigid airship. The seaplanes were mostly obsolescent, capable only of short flights, and lacking in seaworthy qualities.

In the latter part of that year, however, improvements in hull design and construction had so far progressed that the first practical flying boat was turned out for use of the United States Navy.

The problem of insuring the supply of naval seaplanes was solved by the cooperation of the manufacturers and the creation of the naval

The main functions of aircraft in connection with naval warfare, considered apart from the operation of aircraft as a Special Arm, are in the order of their importance:

1.— Scouting and gun spotting in connection with fleet work at sea.
2.— Coast patrol work in liaison with the fleet.
3.— Offensive action against enemy aircraft, surface craft and ship establishments (coast batteries, dock yards, etc.) operating against or menacing the fleet.

Naval scouting subdivides into two branches, strategic and tactical. Strategic scouting requires long flights for observation far in advance of the possible point of conflict; this is, in particular for our country, a problem which can be solved by large rigid airships possessing a flight range of several thousand miles. In such duties airships possess an advantage because sustentation is independent of forward motion. The great buoyancy of large rigid airships furthermore allows the equipment of such vessels with elaborate apparatus for radio communication and with comfortable quarters for the crew — an important requirement for efficient service. During the better part [redacted]

portant functions of naval aircraft for all kinds — seaplanes, airships, and kite balloons. However, owing to the peculiar naval situation during the World War, with the enemy fleet bottled up and the submarine assuming the chief offensive rôle, aircraft had particular prominence in coast patrol and convoy work, as well as giving direct battle to the under-sea boats themselves.

The considerable extension which Germany gave to submarine warfare forced the Allies and later the United States to devise a very complete aerial patrol system to cope with this menace. The anti-submarine warfare was carried out in four modes of operations, namely, routine patrol, escort patrol to convoys, emergency patrol and special bombing patrols for submarine bases.

Large seaplanes with an extensive cruising area were generally used for routine patrol. These planes carried either one or two bombs weighing either 230 or 500 pounds each, and were also provided with machine guns. As a rule smaller type aircraft were used for convoy escort. These were armed like the patrols. Specially designated seaplanes were always kept in readiness or maintained at all times at emergency patrol stations.

For bombing operations against submarine bases, land planes were mainly used, and these were divided into day and night bombing squadrons. Day bombing was carried out by the United States Naval Aviation through the Marine Corps, while the night bombing was effected by the Navy personnel. All of the four mentioned types of patrol were mainly offensive in character as they required the bombing of all enemy submarines encountered and might therefore be mentioned under the third main function of seaplanes. However, their primary purpose was not essentially offensive in that they merely cooperated with the surface patrol assigned to convoy service.

The extraordinary effectiveness of aerial craft in submarine de-

ships and kite balloons — rendered very valuable service during th war. Airships were used mainly for patrols of longer duration, whil kite balloons, attached to convoy vessels, provided an effectual protec tion against submarines. The United States Naval Aviation abroa operated mainly French airships, while American built airship were used for training for patrol on these shores.

With regard to offensive action against aircraft, surface craft, an shore establishments, comparatively little has been done during th war outside of bombing raids already mentioned. However, certai new types of seaplanes have been developed in an experimental way and these are likely to assume considerable importance in futur naval wars. The most interesting development along this line i afforded by the torpedo seaplane, a "ship" equipped with a suitabl cradle from which a regulation torpedo is dropped into the sea, whenc it propels itself against the chosen target. The use of this kind o seaplane has been extremely limited during the war, although promis ing results have been obtained by the British as well as by th Germans.

Probably the most notable development of naval aviati the war was the powerful N. C. type of craft was originally de for hea

and 45,632 men; 42 air stations were in commission, 25 of which were located in France, Great Britain and Italy.

After demobilization was started, shortly after the Armistice, Naval Aviation was limited by an Act of Congress to six seaplane stations within the continental limits of the United States, and a corresponding reduction of personnel and equipment ensued.

At the present time, the problems of aviation are mainly experimental, looking forward to the development of new types of seaplanes for offensive purposes and of large rigid airships for fleet scouting.

As above indicated, possibly future development of aviation in the United States will concentrate many of the aerial activities of the Navy in a united Air Service similar to the plan already adopted by Great Britain and other European countries.

CHAPTER IV

CONVENTION RELATING TO INTERNATIONAL AIR NAVIGATION

THE following convention relative to International Air Nav gation was drafted by the Aeronautical Commission of th Peace Conference.

The Commission was composed of the following delegates:

Two representatives of each of the principal Powers, United State of America, British Empire, France, Italy and Japan.

One representative of each of the following seven Powers wit limited interests, designated by the Supreme Council, namely Be gium, Brazil, Cuba, Greece, Portugal, Roumania and Serbia, wh were to represent all the Powers with limited interests assembled a the Peace Conference.

The representatives designated by the U[illegible]
the Commission, Rear Ad[illegible]

mittee of the Manufacturers Aircraft Association made a thorough study of an early draft of the Convention and the later draft of this instrument incorporated several of the changes suggested by this committee.

CONVENTION RELATING TO INTERNATIONAL AIR NAVIGATION

CHAPTER I

GENERAL PRINCIPLES

ARTICLE 1.— The High contracting Parties recognise that every Power has complete and exclusive sovereignty over the air space above its territory.

For the purpose of the present Convention the territory of a State shall be understood as including the national territory, both that of the mother country and of the colonies, and the territorial waters adjacent thereto.

ARTICLE 2.— Each contracting State undertakes in time of peace to accord freedom of innocent passage above its territory to the aircraft of the other contracting States, provided that the conditions laid down in the present Convention are observed.

tors possess such nationality, and unless the company fulfils all other conditions which may be prescribed by the laws of the said State.

ARTICLE 8.— An aircraft cannot be validly registered in more than one State.

ARTICLE 9.— The contracting States shall exchange every month among themselves and transmit to the International Commission for Air Navigation referred to in article 34 copies of registrations and of cancellations of registration which shall have been entered on their official registers during the preceding month.

ARTICLE 10.— All aircraft engaged in international navigation shall bear their nationality and registration marks as well as the name and residence of the owner in accordance with Annex A.

CHAPTER III

CERTIFICATES OF AIRWORTHINESS AND COMPETENCY

ARTICLE 11.— Every aircraft engaged in international navigation shall, in accordance with the conditions laid down in Annex B, be provided with a certificate of airworthiness issued or rendered valid by the State whose nationality it possesses.

ARTICLE 12.— The commanding officer, pilots, engineers and other members of the operating crew of every aircraft shall, in accordance with the conditions laid down in Annex E, be provided with certificates of competency and licences issued or rendered valid by the State whose nationality the aircraft possesses.

ARTICLE 13.— Certificates of airworthiness and of competency and licences issued or rendered valid by the State whose nationality the aircraft possesses,

sons of general security it will be obliged to land if ordered to do so by means of signals provided in Annex D.

Every aircraft which passes from one State into another shall, if the regulations of the latter State require it, land in one of the airdromes fixed by the latter. Notification of these airdromes shall be given by the contracting States to the International Commission for Air Navigation and by it transmitted to all the contracting States.

The establishment of international airways shall be subject to the consent of the States flown over.

ARTICLE 16.— Each contracting State shall have the right to establish reservations and restrictions in favour of its national aircraft in connection with the carriage of persons and goods for hire between two points on its territory.

ARTICLE 17.— The aircraft of a contracting State which establishes reservations and restrictions in accordance with Article 16, may be subjected to the same reservations and restrictions in any other contracting State, even though the latter State does not itself impose the reservations and restrictions on other foreign aircraft.

ARTICLE 18.— Every aircraft passing through the territory of a contracting State, including landing and stoppages reasonably necessary for the purpose of such transit, shall be exempt from any seizure from on the ground of infringement of patent, design or model, subject to the deposit of security the amount of which in default of amicable agreement shall be fixed with the least possible delay by the competent authority of the place of seizure.

CHAPTER V

RULES TO BE OBSERVED ON DEPARTURE WHEN UNDER WAY AND ON LANDING

ARTICLE 19.— Every aircraft engaged in international navigation shall be pro-

charges is open to public use by its national aircraft, shall likewise be open t the aircraft of all the other contracting States.

ARTICLE 25.— Each contracting State undertakes to adopt measures to ensu that every aircraft flying above the limits of its territory and that every aircra wherever it may be, carrying its nationality mark, shall comply with the regul tions contained in Annex D.

Each of the contracting States undertakes to ensure the prosecution and pu ishment of all persons contravening these regulations.

CHAPTER VI

PROHIBITED TRANSPORT

ARTICLE 26.— The carriage by aircraft of explosives and of arms and mun tions of war is forbidden in international navigation. No foreign aircraft sha be permitted to carry such articles between any two points in the same co tracting State.

ARTICLE 27.— Each State may, in aerial navigation, prohibit or regulate t carriage or use of photographic apparatus. Any such regulations shall be a once notified to the International Commission for Air Navigation, which sha communicate this information to the other Contracting States.

ARTICLE 28.— As a measure of public safety, the carriage of objects other tha those mentioned in articles 26 and 27 may be subjected to restrictions by an contracting State. Any such regulations shall be at once notified to the Intern tional Commission for Air Navigation, which shall communicate this inform tion to the other contracting States.

ARTICLE 29.— All restrictions menti

ARTICLE 33.— Special arrangements between the States concerned will determine in what cases police and customs aircraft may be authorised to cross the frontier. They shall in no case be entitled to the privileges referred to in Article 32.

CHAPTER VIII

INTERNATIONAL COMMISSION FOR AIR NAVIGATION

ARTICLE 34.— This chapter arranges for a permanent International Commission for Air Navigation, placed under the League of Nations and composed of two representatives of the United States, France, Italy and Japan, each; one representative of Great Britain and one of each of the British Dominions and India; and one representative of each of the other contracting states.

" Each of the five states first named (Great Britain, the British Dominions and India, counting for this purpose as one state) shall have the least whole number of votes which, when multiplied by five, will give a product exceeding by at least one vote the total number of the votes of all the other contractnig states."

The functions of this Commission are to carry out the provisions of the Convention, to alter and amend it as deemed convenient and generally to administrate the International Air Navigation.— EDITOR.

COUNTRY	NATIONALITY MARK	REGISTRATION MARKS
UNITED STATES OF AMERICA	N	All combinations made in accordance with the provisions of Section I (a) of this Annex, using a group of 4 letters out of the 26 of the alphabet, each group containing at least one vowel, e. g., ADCJ, PURX.
BRITISH EMPIRE	G	
FRANCE	F	
ITALY	I	
JAPAN	J	
BOLIVIA	C	All combinations made with B as first letter.
CUBA	C	All combinations made with C as first letter.
URUGUAY	C	All combinations made with U as first letter.
GUATEMALA	L	All combinations made with G as first letter.
BRAZIL	P	All combinations made with B as first letter.
PERU	O	All combinations made with P as first letter.
HONDURAS	X	All combinations made with H a-

[redacted]

terials must be approved. The control of the construction and tests shall be in accordance with certain standard minimum requir

4. The aircraft must be equipped with suitable instruments for safe navi

5. The standard minimum requirements of paragraphs 1 to 3 inclusiv be fixed by the International Commission for Air Navigation. Unt have been so fixed each contracting State shall determine the regu under which certificates of airworthiness shall be granted or remain

ANNEX C

LOG BOOKS

SECTION I

JOURNEY LOG

This shall be kept for all aircraft and shall contain the followin ticulars: —

(*a.*) Category to which the aircraft belongs: its nationality and regis marks; the full name, nationality and residence of the owner; n maker and the carrying capacity of the aircraft.

(*b.*) In addition for each journey —

(i.) The names, nationality and residence of each of the members of the

(ii.) The place, date, and hour of departure, the route followed, and al dents *en route* including landings.

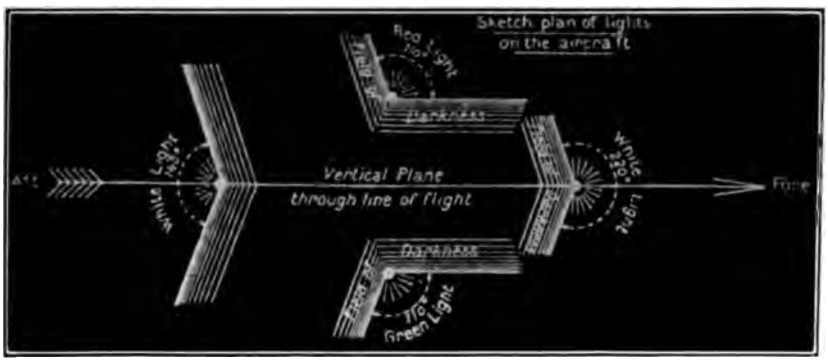
SECTIONS II–V

In these sections, Aircraft, Engine, and Signal Logs are provided for in and instructions are given for their use.— EDITOR.

ANNEX D

RULES AS TO LIGHTS AND SIGNALS — RULES OF THE AI

rules as shown in the sketch (attached) shall be determined when the aircraft is in its normal attitude for flying on a rectilinear horizontal course.



1. The rules concerning lights shall be complied with in all weathers from sunset to sunrise, and during such time no other lights which may be mistaken for the prescribed lights shall be exhibited. The prescribed navigation lights must not be dazzling.

2. A flying machine, when in the air or manœuvring on land or water under its own power, shall carry the following lights: —

(*a.*) Forward, a white light visible in a dihedral angle of 220 degrees bisected

time. The distance between the lights comprising a pair shall not be less than 2 metres.

The rest of this paragraph, numbers four to thirteen, of rules as to lights, is covered with the regulation for airships and balloons in flight and at rest, with a note dealing with precautionary measures to avoid collisions with surface craft. It also regulates the lights on flying machines, stationary or not anchored.—EDITOR.

SECTION II

RULES AS TO SIGNALS

Extremely detailed regulations are provided in paragraphs 14 to 20 for the showing of lamps, flares and smoke signals by aircraft about to land or when in distress.— EDITOR.

SECTION III

RULES OF THE AIR

21. Flying machines shall always give way to balloons fixed or free and to airships. Airships shall always give way to balloons, whether fixed or free.

22. An airship when not under its own control shall be classed as a free balloon.

23. Risk of collision can, when circumstances permit, be ascertained by carefully watching the compass bearing and angle of elevation of an approaching aircraft. If neither the bearing nor the angle of elevation appreciably change, such risk shall be deemed to exist.

24. The term "risk of collision" shall include risk of injury due to undue proximity of other aircraft. Every aircraft that is required by these rules to give way to another to avoid collision, shall keep a safe distance, having regard to the circumstances of the case.

25. While observing the rules regarding risk of collision contained in paragraph 24, a motor-driven aircraft must always manœuvre according to the rules contained in the following paragraphs, as soon as it is apparent that, if it pursued its course, it would pass at a distance of less than 200 metres from any part of another aircraft.

26. When two motor-driven aircraft are meeting end on or nearly end on each

it is forward or abaft the direction mentioned above from the other aircraft, it should, if in doubt, assume that it is an overtaking aircraft and keep out of the way.

29. Where by any of these rules one of the two aircraft is to keep out of the way, the other shall keep its course and speed. When, in consequence of thick weather or other causes, the aircraft having the right of way finds itself so close that collision cannot be avoided by the action of the giving-way aircraft alone, it shall take such action as will best aid to avert collision.

30. Every aircraft which is directed by these rules to keep out of the way of another aircraft shall, if the circumstances of the case admit, avoid crossing ahead of the other.

31. In following an officially recognised air route every aircraft, when it is safe and practicable, shall keep to the right of such route.

32. All aircraft on land or sea about to ascend shall not attempt to "take off" until there is no risk of collision with alighting aircraft.

33. Every aircraft in a cloud, fog, mist or other conditions of bad visibility shall proceed with caution, having careful regard to the existing circumstances and conditions.

(*a.*) ***Test for Altitude and Gliding Flight.*** **A flight without landing during which the pilot shall remain for at least an hour at a minimum altitude of 2,000 metres above the point of departure. The descent shall finish with a glide, the engines cut off at 1,560 metres above the landing ground. The landing shall be made without restarting the engine and within 150 metres or less of a point fixed beforehand by the official examiners of the test.**

(*b.*) ***Tests of Skill.*** **A flight without landing around two posts (or buoys) situated 500 metres apart making a series of five figure-of-eight turns, each turn reaching one of the two posts (or buoys). This flight shall be made at an altitude of not more than 200 metres above the ground (or water) without touching the ground (or water). The landing shall be effected by:**

(i.) Finally shutting off the engine or engines at latest when the aircraft touches the ground (or water).

(ii.) Finally stopping the flying machine within a distance of 50 metres from a point fixed by the candidate before starting.

2. *Special Requirements:*

Knowledge of rules as to Lights and Signals, and Rules of the Air. Rules for Air Traffic on and in the Vicinity of Airdromes. A practical knowledge of international air legislation.

(B.) PILOT'S FLYING CERTIFICATE FOR FLYING MACHINES USED FOR PURPOSES OF PUBLIC TRANSPORT

1. *Practical Tests:*

In each practical test the candidate must be alone in the flying machine.

(*a.*) The tests for altitude and gliding flight and for skill are the same as those required for a private pilot's flying certificate. Candidates already in possession of the latter certificates are not required to pass these tests again.

(*b.*) Test of endurance consisting of a cross-country or oversea flight of at least 300 kilometres, after which the final landing shall be made at the point of departure. This flight shall be made in the same flying machine within eight hours. It shall include two obligatory landings (during which the machine must come to rest), which shall not be at the point of departure, but which shall be fixed by the judges.

At the time of departure the candidate shall be informed of his course and furnished with the appropriate map. The judges will decide whether the course

(*b.*) ***Engines:***

General knowledge of internal combustion engines, including functions of the various parts; a general knowledge of the construction, assembling, adjustment, and characteristics of aero-engines.

Causes of the faulty running of engines and of breakdown.

Practical tests in running repairs.

(*c.*) ***Special Requirements:***

Knowledge of Rules as to Lights and Signals and Rules of the Air, and Rules for Air Traffic on and in the Vicinity of Airdromes.

Practical knowledge of the special conditions of air traffic and of international air legislation.

Map reading, orientation, location of position, elementary meteorology.

REMARKS

The practical tests shall be carried out within a maximum period of one month.

They may be carried out in any order, and each may be attempted twice. They shall be witnessed by properly accredited examiners, who will forward the official report to the proper authorities.

tial bodies: method of determining latitude, longitude, time and azimuth, maps and charts, how to read them, compass, magnetic meridians, variations, deviations, aeronautical navigation instruments, and so forth.— EDITOR.

SECTION V

This section is devoted to international medical requirements for air navigation. It provides an exhaustive physical examination for candidates as pilots or navigators.— EDITOR.

ANNEX F

INTERNATIONAL AERONAUTICAL MAPS AND GROUND MARKINGS

SECTIONS I AND II

This annex illustrates an international system of aerial maps on the scale of 1: 1,000,000; and all local maps on a scale of 1: 200,000. The details of what the maps will show are given in this section. SECTION II provides for an international system of ground marks. These marks differ widely from those now in use in the United States.— EDITOR.

CHAPTER V

REPORT OF AMERICAN AVIATION MISSION

IN the summer of 1919 a step was taken by the United States Government which was destined to help place the Aviation Industry in America first among the nations of the world.

Under instructions from Secretary of War Baker, the American Aviation Mission was formed, consisting of: Hon. Benedict Crowell, the Assistant Secretary of War; Howard E. Coffin, Member of the Council of National Defense; Henry C. Mustin, Captain, U. S. Navy; Halsey Dunwoody, Colonel, Air Service, U. S. A.; James G. Blair, Jr., Lieutenant-Colonel, General Staff, U. S. A.; George H. Houston, President, Wright Aeronautical Corp.; C. M. Keys, President, Curtiss Aeroplane & Motor Corp.; S. S. Bradley, General

the above sub-heads the results of these investigations are presented to you, which, in the opinion of the Mission, demand the most earnest and immediate consideration along the broadest lines, with a view to establishing some fixed policy which will save the aircraft situation in the United States and give the United States an equal place with the great powers of Europe in this great new commercial development.

The American Aviation Mission therefore recommends *the concentration of the air activities of the United States, military, naval and civilian, within the direction of a single Government agency created for the purpose, co-equal in importance with the Departments of War, Navy and of Commerce, to be called in this report, for the purposes of identification, the National Air Service.*

In making the above recommendations, the following views and data of the Mission are presented:

Visits were made by the Mission to England, France, Italy and conferences have been held with those largely responsible for the successful prosecution of the war and especially with those men most experienced in the aerial development within those countries. Among others, interviews have been had with:

FRANCE: Maréchal Foch, Commandant-en-Chef des Armées Alliées; André Tardieu, Ministre des Affaires Franco-Américaines; Général M. Duval, Chef de Service de l'Aeronautique; Jacques Dumesnil, Deputé, formerly Sous-Secrétaire de l'Aeronautique; M. Loucheur, Président du Conseil de Guerre, now Minister of Reconstruction; Daniel Vincent, Deputé, formerly Sous-Secrétaire de l'Aviation; Gaston Minier, Deputé, Chef du Comité Aeronautique au Senat; and Major d'Aiguillon of the Commission Interministerielle de l'Aviation Civile

arate department of Aeronautics placed transitorily under the Ministry of War — an intermediate step possible without legislation and looking to the early creation of an Independent Ministry of the Air:

LETTER FROM M. CLEMENCEAU TO PRESIDENT WILSON.

"February 16th, 1919.

"The President of the Council, and
"The President of the Interallied Peace Conference.
"To the President of the Republic of the United States.
"Interallied Aviation Committee:
"Mr. President:

"I have the honor to acknowledge the receipt of your answer of February 7th, to my letter of January 24th. I enclose herewith, copies of the letters which I have received from Lord Milner and from Monsieur Orlando, as well as my replies.

"I am pleased to note that you agree in principle with my proposition to create an Aviation Committee for after the war. I take the liberty of insisting on the necessity of creating this Committee without delay, in order to be able to utilize it as an advisory organ for the Peace Conference. Indeed, the clauses for aerial protection seem to have at least an importance equal to the clauses for military and naval protection; and it is of the greatest interest to have a study made by competent personalities of the measures to take against the eventual constitution of a German military fleet. I cannot insist too strongly on the imperious necessity of this study, on account of the proximity of Germany to Lon-

"With this object in view, and according to the propositions of an interministerial conference which I am able to assemble, I have the honor to submit for your signature, the following decrees creating an organ of general coordination of aviation.

"This should not be confused with any of the particular aviations of the various ministerial departments. At its origin, it will be attached transitorily to the Ministry of War.

"I am, Sir, yours respectfully,
"GEORGES CLEMENCEAU,
"President of the Council, War Ministry."

Even before the report of this Mission can be given consideration, a step similar to that proposed by France will have been taken by Italy. Here, however, the Department of Aeronautics is being placed under the Ministry of Transportation — a make-shift arrangement frankly acknowledged transitory and immediately possible without the legislation needed to create the clearly foreseen ultimate — the Italian Ministry of Air.

accessory equipment. The training of personnel including engineering, production, inspection, maintenance and operating forces — covering some fifty distinct trades and some seventy-five industries, has proved in itself a stupendous task when undertaken upon the basis of the war emergency alone.

6. That the rapid adaptation of aircraft to the commercial uses of peace is everywhere being studied and planned. Under the forced draft of war, this newest and fastest agency of transportation has been brought to a high state of development. It must now be redesigned to meet the progressive demands of a civilization at peace.

7. That because of its great speed and range of operation, oceans, states and even countries are being passed over with a greater facility than are townships and counties traversed by the motor car. The need for international agreements governing the construction, operation and safety of aerial apparatus of all kinds is immediately before us.

8. That for the first time in the world's history, the stage is set for a close international cooperation in the development of a great art at the very threshold of its era of commercial utility. Great Britain, France, Italy and Japan not only invite but urge the United States to share in this work.

9. That just as we now have National, International and Interstate regulations, laws and agreements covering rail and steamship travel and the safety and navigation of the seas, so must we have similar regulations governing aircraft and the uses of aerial navigation throughout the world. The International Committee sitting in Paris, under the Peace Conference, gives the first long step

(f) International standards covering the marking or charting of air routes and of landing places for both day and night use.

(g) International specifications and rules governing the construction, equipment and operation of standard airdomes, landing stations, signal towers and other aids to aerial navigation.

(h) Port regulations and fees covering seaplanes.

(i) Federal taxation of aircraft and license for its use.

(j) Safety measures and devices; legislation forcing adoption.

(k) Fire underwriter standards, regulations and safeguards; insurance of machines, of material and of persons in transit (property and life).

(l) The legal status of privately owned aircraft; the property rights of the air; liability for damage inflicted and incurred.

(m) International standards and specifications covering accepted practice in quality of materials, in factors of safety, and in methods of construction; an engineering literature of this new art must be created by International approval.

(n) Maps and navigation charts of the United States and its territories.

13. That we of today are conceivably no more qualified to judge as to the scale and development of the aircraft of ten years hence than were we of even five years ago able to foretell the achievements of today. We must bear in mind always that for every one mind focussed upon things aeronautical in this earlier period, some thousands of keen minds are now versed in the aircraft art. With proper Governmental encouragement, rapid progress seems inevitable.

14. That the broadest consideration for the ultimate welfare of American avia- [redacted]

England, France and Italy. Great Britain's plan of organization certainly warrants our most careful consideration. Its salient points are clearly set forth in the chart herewith attached. It is not argued that the British method is perfect, but it can be stated without fear of contradiction in any quarter, that it stands today the most comprehensive governmental mechanism yet set up by any nation in the world for the encouragement, upbuilding, direction and control of its air resources. This organization has been born of five bitter years of trial, mistake, experience and progress. It is the product of the best brains in the British Empire focussed under the spur of national need and the demand of the British people. We in America may well study it carefully.

Your Mission, in presenting its recommendations, desires to emphasize the view everywhere encountered that the future of aerial navigation and of aerial development generally, is in only a limited sense a function of military and naval establishments. The air is a medium for commerce and communication and its direction to the peaceful uses of civilization must be unhampered by the necessarily restrictive views of these specialized departments.

RECOMMENDATIONS

A. The concentration of the Air activities of the United States, Civilian, Naval and Military, within the direction of a single Governmental agency, created for the purpose co-equal in importance and in representation with the Departments of the War, Navy and of Commerce.

B. That the agency thus created be charged with full responsibility for placing and maintaining our country in the front rank among nations, in the development and utilization of aircraft for the national security, and in the advancement of the civil aerial transportation and communication arts.

C. That this governmental organization be formed in general as follows:

1st. A civilian Secretary for Air.

2nd. An assistant secretary, a civilian, responsible directly to the Secretary for Air, for the management and operation of the Department.

[illegible] Divisional heads acting as chief of the sub departments of [illegible] Military Aeronautics, (c) Naval Aero-

E. Such curricula and such arrangement of promotion in the National Air Service, and such assignment and pay as to insure to the young man an attractive career whether he elect to remain permanently in the "National Air Service" or return to Army or Navy, or to civil life.

F. The adoption of a system whereby Army, Navy and civil personnel can be circulated in proper proportion through the National Air Service. This personnel would, unless permanently assigned to Air work, be automatically returned to the Military and Naval sources, or to civil life as an Air Service reserve after the educational and service periods in the National Air Service have expired.

It is felt that such a circulating system is vital to the coordination and ultimate efficiency of the three services, and to the desired dissemination of a knowledge of and interest in the air among our people. The young officers of to-day will command the military and naval forces of to-morrow, and will carry with them into the highest ranks an intimate knowledge of aircraft, and of the strategy of its varied uses, in connection with operations on land or sea. The direction of civilian and commercial activities of all kinds will be made possible, and the closest contact and cooperation between the Government and the aeronautical industries assured.

All international relations touching aerial matters fall naturally within the

of our absence, four successful crossings have been made and without the loss of a single life.

There must be no over-optimism. There are years of development and experimentation ahead. As in the case of all the other great agencies of civilization, the commercial and financially profitable use will come slowly. But here the immediate welfare and safety of our nation is involved and an intelligent and efficient direction of our aeronautical affairs will be demanded by the American people. American genius has given to the world the airplane, a new instrument of commerce and of war. But America has left its development to other nations, and too late, realized the mistake of this neglect. She has paid the price! America now again has the opportunity, if not to lead, at least to take her place in the front rank and to gain to herself the full benefit which will surely accrue from an active and sincere cooperation in the engineering activities, and in the scientific and commercial aircraft developments of those nations associated with us in the war.

But this will be impossible, in the future as in the past, if our aircraft activities remain dispersed among the several governmental departments and impossible of coordination for decisive action.

Upon the breadth of view and the vision of those in control of America's policies, depends our future as an air power.

II. COMMERCIAL DEVELOPMENT

The Mission's investigation in France included visits to a number of French factories and flying fields, and interviews with the following gentlemen:

FRANCE: Général M. Duval, Directeur du Service Aeronautique; Senateur Gaston Minier, Chef du Comité Aeronautique au Senat; Pierre Etienne Flandin, Deputé, formerly Chef de l'Organe Interallié de l'Aeronautique; Commandant d'Aiguillon of the Commission Interministrielle de l'Aviation Civile; Commandant de St. Quentin, Chef du Service de Fabrication de l'Aviation; Louis Breguet, of the Breguet Company and Compagnie des Messageries Aeriennes; Bleriot, of the Bleriot Company; Maurice Leblanc, Bleriot Spad Company; Kaherer, Société Astru; Bazaine, Société Nieuport; Maurice Farman, of the M. and H. Farman Company; Granet, Secrétaire du Chambre Syndicale de l'Industrie Aeronautique; Esnault-Pelleterie, Président du Chambre Syndicale de l'Industrie Aeronautique; Lieut. Réné Fonck, premier French ace; Maurice de St. Blanchard, Secretary of the Aero Club de France; and Comte de Libersee, former pilot and at present much interested in the development of civil aeronautics in France.

Among the factories visited were: Morane-Saulnier, Breguet, Bleriot, Farman, Hispano-Suiza and Renault, all of which are engaged in the manufacture of airplanes and motors.

The investigation in Italy included interviews by representatives of the Mis-

3. It is equally difficult to determine the speed with which this development will take place. In fact, this will be determined largely by the opportunities afforded to employ the brains of the engineer and the scientist on the problems involved, which in turn will be controlled by the financial resources available for such work. It is thought by some well informed authorities that the next five or ten years will see this new industry through its initial stages, and established on a self-supporting basis, providing it is encouraged at this time. Adequate support cannot be expected from private enterprise alone, and if no outside aid is given, ten years will probably see this industry in America still struggling for a foothold, and far behind its European competitors who will receive substantial aid of many kinds.

4. History has shown repeatedly that no nation can afford to neglect the highest possible development of its transportation mediums regardless of the opportunities existing for immediate profit to the private enterprise concerned. This is particularly true of aerial transportation, which is not local in its nature, but which is essentially of a national and international character, due to the great distances covered, and to the speed with which it links together far distant points. This principle has been so clearly understood that an International agreement has been established between the Allies and their associates, by which international flight of aircraft has been provided for in a far-sighted manner, thus making immediately possible the flight of private craft from one country to another on a basis as clearly defined by law as that governing the movement of steamships, except, of course, that the practice of ages of ship travel is missing in the case of aircraft.

5. The development of aviation is progressing so rapidly at this time that it is difficult even for those in close touch with it to keep up with its progress. During the past two months the Atlantic has been crossed four times by aircraft: first, by a seaplane of the American Navy, second, by an airplane of Great Britain, and finally, by an airship of Great Britain which has twice demonstrated its ability to fly between England and America. All of this has been accomplished without the loss of a single life. Airships are now building in England which will be able to carry from five to ten tons of mail, in addition to the necessary fuel and crew, and cross the Atlantic from London to New York, in one half the time made by the fastest steamships. Who can say such transportation facilities will not greatly serve civilization, and be of immeasurable value to our own country if properly developed and used.

[illegible] lines of aerial transportation are being used in England and France [illegible] purposes, but the distances in these countries [illegible] justified, so such ventures will [illegible] operation

terminals. The United States Post Office Department has carried mail by airplane from New York to Washington for over a year with a record of nearly one hundred per cent. delivery at each end every day. It is now inaugurating a line from New York to Chicago which will shorten the mail time between these two points to about one-half. It is also projecting a two-day service from New York to San Francisco. England is already desirous of organizing with the United States a trans-Atlantic airship line for mail service which would give a five-day mail service from London to San Francisco. Such a service is entirely possible at this time, and its inauguration depends only upon adequate encouragement and financial support.

7. The risks involved in these ventures, due to unknown conditions of the atmosphere, imperfections of equipment, etc., are still so great as to make them impracticable from the point of view of private enterprise, undertaken for a profit. If left entirely to such private enterprise, aerial transportation will develop slowly and with many losses and backward steps, as did the steamship, the railroad, and the automobile, each of which, however, has ultimately become a vital factor in our civilization.

but since the signing of the armistice it has shrunken to a very small volume. Unless immediate attention is given to its conservation, it will practically disappear, and a considerable portion of the great sums expended in its development will have been spent fruitlessly. This industry does not require a large valume of business to keep it alive and healthy, but it does require a steady and dependable demand, otherwise private capital and enterprise will not long remain interested.

RECOMMENDATIONS

Upon the basis of these conclusions, we offer the following plan for stimulating the development of commercial aviation as an aid to national defense, and as a response to the demand that is already developing for improved commercial transportation through the use of aircraft.

A. The Civil Aviation Division of the National Air Service should establish with the advice of the Army and Navy, and the Division of Military and Naval Aeronautics, a series of flying routes throughout the United States and its possessions and to contiguous foreign countries, which will be of military and commercial value. It should also prepare and publish maps and descriptions of each of these routes, suitable for the use of fliers.

B. There should be provided at national expense certain flying fields in strategic locations, and suitable for military purposes, and encouragement should be given to the various States and Municipalities to provide flying fields upon all flying routes, at points found desirable, thus eliminating the necessity for private ownership of flying fields except for strictly private use. Hangars should be provided at each flying field by the governmental authority owning the field (that is, Federal, State or Municipal), or where such fields are used constantly by private interests, they should be permitted to provide their own hangars immediately adjacent to and opening upon such flying fields.

The operation and use of such flying fields should be controlled by federal law, so as to obtain uniformity throughout the nation and conformity with

of its military personnel. Such a plan would encourage private enterprise to provide facilities for the training of the personnel needed for commercial requirements, which personnel in turn should become a permanent reserve for military requirements in time of need. There should be established at least one school for the teaching of aerodynamics and other branches of the science of aeronautics as recommended under the heading "Organization." Encouragement should be offered to universities throughout the country to establish departments of aeronautical science.

F. The Government should encourage the development of new design and aeronautical technique for commercial purposes along the lines recommended under the heading "Technical Development."

G. The Department of Aeronautics should maintain the closest possible relations with all civilized nations in determining and applying the rules and regulations which will govern the international use of aircraft, and there should be developed as rapidly as is consistent with proper consideration, a body of Federal law governing the use and airworthiness of aircraft for commercial purposes, which will safe-guard life and property, and promote the commercial usage of aerial transportation. In order that commercial aviation may be helped and not hindered by such legal restrictions, it is of vital importance that aerial transportation be recognized at once as an element of interstate commerce and be made subject to one body of *Federal* law applying uniformly throughout all of the United States. It will thereby avoid the complications of individual state control which have proven to be such a handicap to railroad and automobile operation.

III. TECHNICAL DEVELOPMENT

With reference to technical development, your Mission in submitting its recommendations bases the following conclusions on a knowledge of conditions existing in the United States and upon extensive investigations conducted abroad:

(1) (a) The Mission visited plants making or experimenting in materials as follows:

FRANCE: Breguet, Farman, S. P. A. D., Bleriot, Hispana-Suiza, Morane-Saulnier, Renault, and Nieuport.

ITALY: Ansaldo, Macchi, Caproni, Pomilio, Isotta (plant closed by strike), and F. I. A. T.

ENGLAND: Handley-Page, B. A. T., Rolls Royce, Phonenix Dynamo, Bristol, Vickers-Vimy, Cosmos, Sopwith, Grahame-White, A. B. C., and Armstrong-Whitworth.

(b) The Mission has visited laboratory and experimental shops as follows: Institute Sperimentale Aeronautico, Rome; Eiffel Laboratories, Paris; R. A. Factory, Farnborough, England; Isle of Grain Naval Experimental Station, Eng- [illegible] Pullman Dirigible Station, England; Aeroplane Station, Contocelli, Italy, [illegible] Craspiano, Italy.

[illegible] the following governmental official and indus-

emphasis upon the necessity of having these departments strongly represented in the operations of the Technical Division so that they shall be materially helped and not hindered in their research, experiment and development. To the same end, we are of the opinion that lighter-than-air, which in England at the present time is independent, can be best served by making it a strong sub-division of the Technical Division. In both England and France, due to the closeness of the war, the Technical Division is at present dominated by military personnel, but the opinion is unanimous that, as time goes on, civil personnel will supersede military in this division. General Ellington, England, expressed this opinion flatly and General Brooke-Popham, Director of Research, England, holds the same belief. In the Royal Aircraft Factory, at Farnborough, civilian requirements are already overtaking military and naval. It has therefore been deemed wise to take the ultimate step at the outset in America, and a civilian head, of the type now earnestly sought in France and England, is recommended for America.

3. In equipment and personnel, England and France and Italy are maintaining their war strength in the Technical Division. At Farnborough, we found a complete experimental plant, employing about 3,000 men and women, and carrying on actively nearly every line of research, experiment and development in motors, planes and accessories. More than a score of planes, rigged with apparatus for aerodynamic experiment, were in the hangars and in the field. Physical and chemical laboratories seemed busy and fully-manned. Estimating the lighter-than-air and the naval experimental and research personnel, it seems probable that the plant and the personnel engaged in the division in England is [redacted]

Fokker; but the immediate result appears to have been a quick return to the safer measures for encouraging the private designers to design and build, under the direction and assistance of the State. In England, the complete design of airplanes ceased with the S. E. 5; and both government officials and industrial officers offered ample testimony that the making of complete designs was a mistake and would not be repeated, due to its effect upon the private design departments. Without exception the manufacturers appear to take the view that it would be idle to compete by private efforts, if one division of the Government was designing and another division buying, as the Government would inevitably favor its own designers, even though not quite so good. The result of such a policy, therefore, would be to limit the number of sources from which useful designs can be obtained, and also to lower the standard of personnel in the design departments of private firms.

7. In 1918, Sir Arthur Duckham, then Director of Aircraft Supply for England, said:

"As we all know, changes in design, unless they are actually for new types, may be absolutely against production; most of our delays in production in this country and in the countries other than ours, have been due to the effort to obtain too great perfection at too early a time."

Having this in mind, and having in mind also the disastrous effects upon production of similar causes in the United States, your Mission asked explicit questions concerning the plan used by the Technical Division in England to minimize the result of such changes. The method is outlined as follows:

"All changes made necessary by the fact that a machine or motor is dangerous to the flier or to the public are classed as Number I. These are imperative, and are ordered by the Director of Design, without delay. No machine is allowed to be accepted or flown without such changes having been made.

"Important changes involving improvement in performance, etc., are classed as Number II. Such changes are made by order of the Modification Board described below, and became effective only at such time as not to interfere unduly with

the Army, Navy and Civil aviation; and which shall be headed by preferably civilian of wide executive experience. Such a division should include as Assistai to the Director, experienced representatives of Army, Navy and other governme departments interested in aviation, who shall be nominated by the departmer and shall act as advisors upon the special needs of the Service they represent.

(b) That steps be taken forthwith to secure for the United States, the mo advanced equipment for research, experimental and development work and for t testing of motors, planes, balloons, etc., for the testing of materials; for t examination and testing of aeronautical appliances, including armament a instruments; and that such an organization shall be established as shall assu at all times that the research, experimental and development activities of t Government shall be second to none.

design, rather than aim at design on its own account. The policy of the Technical Division should be to maintain and encourage a considerable number of well-manned and well-equipped private design plants and to cooperate with these plants in all undertakings that meet with the approval of the Technical Division, and to place orders with these plants, at fair prices, for design and for experimental construction of motors, planes and appliances. Competition of the government with the industry should be avoided; the only allowable exception being cases where, either on account of expense or for other cause, the Technical Division cannot obtain needed material or design from existing sources.

(h) That careful thought shall be given to the establishment of competition in motor, plane, balloons and accessory design, and encouragement be offered in every reasonable way to the promotion of competitive events and the establishment of standard records.

(i) That the Technical Division shall publish regularly and under competent management all the technical facts and data developed by the Division that may be helpful to the industry, reserving at the same time to itself the right to preserve secrecy in all matters that are deemed to be in the nature of Naval or Military secrets.

(j) That such a Technical Division shall maintain at all times, as close touch as possible with the development abroad and shall maintain representatives in Europe charged with the duty of liaison between the American and European technical organizations.

(Signed) HALSEY DUNWOODY,
Colonel, Air Service, U. S. A.
Assistant Chief, Air Service, A. E. F.
(Signed JAMES A. BLAIR, JR.,
Lieutenant-Colonel, General Staff, U. S. A.
(Signed) GEORGE H. HOUSTON,
President, Wright-Martin Aeroplane Corp.
(Signed) C. M. KEYS,
Vice-President, Curtiss Aeroplane & Motor Corp.
(Signed) S. S. BRADLEY,
General Manager, Manufacturers' Aircraft Assn.

MEMORANDUM NO. 1.

Subject. Report of the Organization Committee, American Aviation Mission.

1. I concur with the report of the Organization Committee of the American Aviation Mission, to which I have affixed my signature, with the following reservations:

(a) Provided that the personnel employed in Naval Aviation operations shall be composed exclusively of officers and enlisted men of the Navy, Marine Corps, Naval Aviation Reserve, and where required for shore establishments, of civilians under the employ of the Navy.

(b) Provided that all advanced training of Naval Aviation personnel excepting advanced aviation engineering courses shall be under the direct control and

experimental aviation work of a class that is exclusively of a Naval character, and that does not involve duplication of efforts and facilities in the proposed Air Department that are common to other aviation branches.

(c) Maintenance of an organization and facilities for conducting the acceptance and tactical tests of complete aviation mechanisms and accessories.

(Signed) HENRY C. MUSTIN,
Captain, U. S. N.

CHAPTER VI

TECHNICAL DEVELOPMENT AIRPLANES, 1914 TO 1919

THE year 1919 in airplane work marks a transition period from the production of military and naval aircraft to the design of purely commercial planes.

In spite of all the difficulties and delays which the Army Air Service experienced, and in spite of all the criticisms it encountered, it may be said that at the signing of the armistice not only had production of standardized military planes reached a tremendous volume, with promise of greater volume in the immediate future, but that a number of most valuable models had been developed by aircraft manufacturers covering the entire field of military requirements.

The Naval Aircraft program, meeting less difficult requirements, and less ambitious in scope, had been more successful as regards production, and at the termination of the war the Navy also was in possession of a number of most valuable types, some of which were distinctly in advance of anything built abroad.

SINGLE-SEATER FIGHTERS

No American single-seater fighters were produced during the war, and the Spad and S. E.-5 formed the bulk of equipment for this in the American Army. During the year 1919 these were replaced by the Thomas-Morse M. B.-3, the Ordnance and other single-seater fighters.

TWO-SEATER FIGHTERS

At the conclusion of the armistice, American designers had fully developed a number of brilliant models of the two-seater fighter type.

A survey of these models gives a very fair idea not only of the general possibilities of the best designs but serves to illustrate many

speed of 136 miles per hour, and was beautifully balanced and maneuverable.

The Loening two-seater monoplane attracted very general attention because of the bold and original employment of rigid trussing for monoplane construction, and other interesting departures from standard practice, such as the new type of radiator, and the exposed engine.

AMERICAN PROGRESS

It is gratifying to observe how far superior these American products — Curtiss, Lepere, Loening, Phipps, Thomas — were to the D. H.-4 and other foreign machines corresponding in type.

NIGHT BOMBERS

The war developed one type of ship which could be immediately utilized for peace service, and this was the night bomber. Capable of carrying ten or more passengers, and equipped with multiple engines, they are capable of flying with part of the power plant out of commission. The Glenn L. Martin bomber was a particularly successful American example of this type, and has since passed, with

With the cooperation of the Forest Products Laboratory, and a number of plywood manufacturers, considerable work was done in the development of veneer fuselages, such as those introduced into this country by the L. W. F. Engineering Co., which were systematically designed, built and sandtested. The final type arrived at could be built from veneer panels such as could be supplied by any plywood manufacturer, formed readily to any streamline shape, and have less weight for the same strength than a truss fuselage of the same size and strength.

In the engine field, much experimentation on the Liberty Twelve enabled the final touches to be placed on this wonderful product of American genius. Constant help was given to the various workers on the turbo-compression systems of which fuller mention is given later in these pages.

It may be pointed out here that while the greater part of our energies was concentrated on the Liberty Twelve, the Americanization and large production of the Hispano-Suiza by the Wright-Martin factory was a notable and extremely useful achievement.

AIRCRAFT DURING THE WAR

Satisfactory as was the Navy's record in the engineering development of its planes, its record from a production standpoint was equally satisfactory. In production work the Curtiss Aeroplane and Motor Corporation, the Aeromarine Plane and Motor Company, the L. W. F. Engineering Company, and the Naval Aircraft Factory at Philadelphia, played, among others, a very important part.

It is a matter of some pride to the Navy that their aircraft work was to a large extent along lines of original American development and that real technical progress was achieved in many directions by the able body of Naval Constructors responsible for the work.

Thus the design of the hull in the N. C. flying boat in which the Navy cooperated closely with the Curtiss Co., marks a real achievement in design. As a result of careful basis work, the fine lines of the hull allowed a speed of 65 miles per hour on the water. While in the early flying boats it was considered necessary to have great width to make the boat plane at reasonably low speeds, and not over 100 pounds of displacement had been allowed per inch width, in the N. C. hull, the radical step was made getting planing by speed rather than by width. The N. C. boats start with 233 pounds load per inch run. The bare hull weighs only 2800 pounds, yet the displacement

load of 11.7 pounds per square foot in the air, and have a total area of 2380 square feet, their structural weight is only 1.2 pounds per square foot. This low figure was only achieved by a great amount of research and experiment so as to determine the best material to adapt and its disposition.

PEACE TIME DEVELOPMENTS

The sense of final achievement, the confident feeling of having equaled, and in some respects surpassed, the efforts of European manufacturers, did not help American manufacturers in finding the true policy, commercial and technical, for the work of peace time development. An immediate curtailment of production, and general depression ensued. This was followed by gradual resumption of development work, and the production of several promising commercial types, and a number of small commercial aircraft enterprises.

THE SMALL CHEAP SPORTING MACHINE

The very widely spread conviction that aeronautics held a large field for the cheap sporting airplane was justified during the year by the large sales of the rebuilt Canadian and American J. N.'s, equipped with the Curtiss OX motors. At the same time a number of even smaller planes, equipped with smaller power, were built and offered for sale. These deserve careful study. The possibility of building successful planes on a cheap commercial basis, with not much more power than was employed in the very early days of avia-
...mpanied by proper licencing and control will offer a dis-
... Engineering Corporation Ace is an

door for convenient entry or exit. The design constitutes an apparently very useful type, which is certain to be the forerunner of a class.

Nothing illustrates so clearly the possibility of aerodynamic refinement as two designs of the Curtiss Company equipped with the same 90–100 horse-power OX motor. Thus the Curtiss Oriole weighing 2188 pounds attains a maximum speed of 85 miles an hour. The well-known Curtiss J. N.-4, with a maximum load of 1900 pounds, and two men only attains a speed of 73 miles per hour.

The Dayton Wright Airplane Co. has developed two striking models, both of the enclosed type. One, the K. T., is equipped with the Liberty engine, is designed for a speed of 125 miles per hour and carries a 6 hour fuel capacity. Both this model and the O. W.-1 are luxuriously finished, combining comfort and beauty with safety. The O. W. is Hispano-Suiza powered.

THE SPEEDIEST AIRPLANE FOR 1919

As far as published records go, the fastest American airplane for 1919 is the Thomas-Morse Single Seater Fighter M. B.-3, which has a high speed record of 164 miles per hour and a climb of 10,000 feet in 4 minutes 52 seconds, while carrying full military load. The photograph indicates that no very unconventional features are present in the design. Speed is gained by refinement in detail, hidden fittings, a good streamline body.

THREE-SEATER SEAPLANES

The same reasons that may lead to the popularity of three-seater land airplanes are likely to hold for the three-seater seaplane and 1919 has seen several flying boats of this character produced.

An interesting example of the three-seater flying boat is the Curtiss M. F. flying boat equipped with OXX 100 horse-power motor, for which a 150 horse-power K-6 may be substituted. A very pleasing and finished design, it is on more standard lines than the V. E.-10.

If further proof were necessary of the general utility of the three-seater flying boat, the Aeromarine Model 50, equipped with the Aeromarine 125–130 horse-power motor, which has a high speed of 80 miles per hour, could be used as an excellent example.

The V. E.-10 built by the Lewis & Vought Corporation is another interesting example of this type. While for pleasure purposes, and

for general sea-worthiness the flying boat is superior to the hydro-airplane, the long hull which it has been customary to employ has militated against quick get-away. The success of the N. C.-4 was in a large measure due to the fact that a shorter hull had been coupled to outriggers for carrying the tail. In the V. E.-10 a similar construction has been adopted with satisfactory results. This construction gives the V. E.-10 a very strong resemblance to the N. C. boats.

TRANSPORTATION AND MAIL PLANES

While no commercial transportation line has so far been definitely established in this country, yet the interest in aerial transportation is constantly growing. The Lawson Company of Milwaukee have designed a twin-engine machine — two Liberty's — for the avowed purpose of a transportation line between New York and Chicago. The photographs indicate clearly the large seating capacity of the plane — 26 passengers are to be carried in all. The machine fully loaded weighs between 12,000 and 13,000 pounds, has a total wing area of 17,000 square feet, and is of sturdy, though unrefined con-

While a number of new types of planes have been ordered by the Aerial Mail, the service is too young to be identified as yet with anything but modified war equipment such as the D. H.-4. A very interesting piece of practical engineering is the rebuilding of the D. H.-4 by the L. W. F. Company to take first two Hispanos of 150 horsepower and subsequently two Liberty Sixes on either wing in lieu of the single Liberty 12. The rebuilt plane has had its wing area increased by a larger section in the upper wing and two center panels in the lower wing. The D. H.-4 was rebuilt for the express purpose of utilizing already available equipment, and yet having a twin-engine machine, minimizing possibility of failure. The twin D. H. while carrying a heavier mail load than the ordinary D. H.-4, was able to maintain its altitude on a single engine at an altitude of 1,200 feet. This is a very significant fact for airplane designers.

The first of the Post Office's fleet of big mail carriers have been built by the Glenn L. Martin Company, along the general lines of the bomber. Many carry six hours' fuel and 1,500 pounds of mail in addition to a crew of two. Trap doors are built in the fuselage to facilitate the discharge of the cargo.

ordinated with the engine and the airplane. European engineers are also working on the development of a variable pitch propeller and a two-propeller arrangement, the first of the ordinary pitch and the second of an extraordinary, to be used at high altitudes.

An interesting development at McCook Field was the construction of a wind tunnel operated by a 24 blade suction fan. The tunnel has a minimum throat diameter of 9 inches, at which point a speed of over 350 miles an hour is attainable. In this connection, special reference should be made to the wind tunnel and other laboratory facilities developed by the Curtiss Company at Garden City.

The importance of the air-cooled aeronautical motor is fully realized in this country. While no substantial development has been formally noted, the Dayton-Wright Company have done some vital fundamental work and it is understood that similar study is being carried on by the Wright Aeronautical and L. W. F. companies.

Reports from England show very valuable progress. A nine cylinder ABC engine developed 340 horse-power with a weight complete of 600 pounds, of 1¾ pounds per horse-power. As the air-cooled engine carries neither water nor radiator, this shows remarkable progress over the old type. A Cosmos Jupiter engine, also a nine-cylinder stationary air-cooled type, gave 450 horse-power for a weight of 662 pounds, an extraordinary figure.

One of the most interesting phases of aeronautical activity during the year, and one which is likely to have the greatest possible influence on the commercial growth of the industry is the construction and use of parachutes. The Army has developed completely successful parachutes which, strapped in a pack on the back of the aviator, acting at the same time as a cushion operated whether by a rip-cord attached to the plane or by the wearer himself, have enabled numerous per-

CHAPTER VII

TECHNICAL DEVELOPMENT, BALLOONS AND AIRSHIPS, 1914–1919

THE technical development of aerostats — which are popularly called lighter-than-air craft — has made enormous strides since the beginning of the World War.

Nonrigid Airships.— The German submarine warfare was more than any other single factor responsible for the development of new airship types in the Allied countries. The ability of airships to regulate their flying speed and to extend vision below the surface of the seas, made of these craft an extremely valuable auxiliary to the

British Blimp, but incorporating a number of refinements. Nine of these B-class ships were built by The Goodyear Tire & Rubber Company, five by The B. F. Goodrich Company and two by the Connecticut Aircraft Company. About 170 pilots were trained on the B-class ships and 400,000 miles flown on coast patrol prior to the Armistice.

The extension of submarine warfare and the change in the tactics of undersea boats prompted Great Britain to develop in 1917 larger types of nonrigid airships, capable of lifting a greater load and having a longer endurance. These were used with great success for coast patrol and convoy work and for extended cruising.

At the same time the French Naval Air Service introduced a non-rigid which was chiefly remarkable for its armament; this consisted of a 37 milimeter aircraft gun, firing a 1-pound shell. These ships were the only ones built in any country during the war to carry artillery, though machine guns were used on both Allied and German airships.

In 1918 an excellent type of coast patrol airship was produced in the United States to the designs of the Navy Department. Owing to careful design, the ships attain a speed of 60 miles per hour with only 250 horse-power, furnished by two Hispano-Suiza or two Union engines — a higher efficiency ratio than has hitherto been obtained anywhere. Another factor which greatly contributed to this result was the use of the "finger patch" rigging, a type independently developed by The Goodyear Tire & Rubber Company, although it bears a certain resemblance to the Eta Patch. In this system, which permits to eliminate the heavy suspension girdle of German origin, the suspension wires are attached to patches of fabric strips, in the form of a hand, which are cemented and sown to the envelope. The finger patch rigging insures a very wide distribution of the load and thus

means of wires and access to them is obtained from a tube which leads through the center of the ship to a gun platform fitted on the top.

Among the principal developments produced in Italy is an ingenious arrangement for compensating a contraction of gas in Forlanini airships. These have a double envelope, the inner one containing the gas, while the space between the inner and outer envelopes acts as a ballonet. Pressure in this space is derived from the air stream which strikes the nose of the airship in flight; this is admitted by means of a valve fitted in the bow, and is operated from the control car. An outlet valve of the spring-loaded type is fitted on the stern and automatically relieves the pressure in the air space whenever the latter reaches the designed limit.

Rigid Airships.— Real advance in rigid airship design and performance since 1914 has been, with few exceptions, limited to Germany, which entered the war with an efficient Zeppelin fleet and fifteen years' experience. The history of German Zeppelin development during the war is one of continuous increase in size and horse-

[redacted]

propellers, instead of which engines and propellers are mounted in streamline cars along the sides of the hull.

With the knowledge gathered from Zeppelins brought down in the Allied lines, Great Britain succeeded in producing in 1918 some very serviceable rigids, among which the R-34 type of transatlantic fame. The development of an original British rigid design just started when the Armistice intervened and ultimately caused the virtual scrapping of the British airship program. As a result, the largest British airship laid down — the R-38 — was sold to the United States Navy. This vessel, which is still in course of construction, has a capacity of 2,700,000 cubic feet, and is driven by six engines totaling 1,900 horse-power. The useful load will be in

cost has been reduced from $2,000 per cubic foot to about 10 cents per cubic foot,— a remarkable achievement — helium is still too expensive for commercial uses, and experiments are continued to further reduce its price. The gas contemplated by the Navy for all-round aircraft use will be a mixture containing 85 per cent. helium and 15 per cent. hydrogen.

A large production plant is in the course of construction at Fort Worth, Texas, in the vicinity of which large pools of natural gas, containing about 2 per cent. of helium, exist. Supplies of helium are as yet very limited.

The great changes which occur in the buoyancy of airships, mainly owing to a greater amount of radiant heat by day than by night, result in a considerable amount of gas and ballast being wasted in navigation. To overcome this drawback, experiments have been conducted in England with a view to condensing the steam formed in the engine exhaust and it has been possible to collect about 80 per cent. of the corresponding weight of the gasoline burned. On the other hand, the possibility of using hydrogen as an engine fuel has also been investigated; it was found that this can be done without danger,

1918 a kite balloon of similar features but which differs from the Caquot in that it has a spherical envelope. This so-called Avorio-Prassone balloon was extensively used on the Italian Front, where it rendered excellent service and proved easier to handle and capable of greater stability in high winds than the Caquot balloon.

CHAPTER VIII

MANUFACTURERS AIRCRAFT ASSOCIATION, INC.

Trustees

DR. JOSEPH S. AMES, National Advisory Committee for Aeronautics. Member of the faculty of Johns Hopkins University.

W. BENTON CRISP, General Counsel, Manufacturers Aircraft Association.

ALBERT H. FLINT, President Manufacturers Aircraft Association.

Directors

ALBERT H. FLINT, L. W. F. Engineering Co., College Point, Long Island, New York.

GEORGE W. HOUSTON, Wright Aeronautical Corp., New Brunswick, New Jersey.

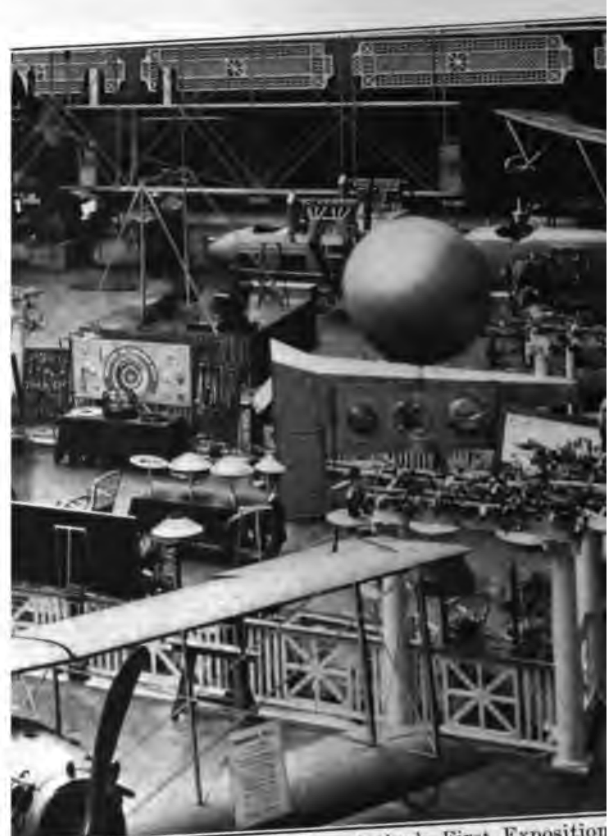
GLENN L. MARTIN, Glenn L. Martin Co., Cleveland, Ohio.

F. L. MORSE, Thomas-Morse Aircraft Co., Ithaca, New York.

J. K. ROBINSON, JR., Gaullaudet Aircraft Corp., East Greenwich, Rhode Island.

FRANK H. RUSSELL, Curtiss Engineering Corp., Garden City, Long

Garden, New York, where Manufacturers Aircraft Association held its first exposition, Ma
1919.



the Manufacturers Aircraft Association's First Exposition

first aeronautical exposition to be held after the cessation of hostilities in the World War.

The following is a summary of the principal exhibits:

MANUFACTURERS' EXHIBITS

AIRPLANES AND SEAPLANES

AEROMARINE PLANE & MOTOR COMPANY, Keyport, New Jersey.
Model "50" Flying Boat. Three-seater sport machine.

GIO. ANSALDO & CO., Genoa, Italy.
Exhibit S. V. A. Biplane. Pursuit machine.

BOEING AIRPLANE CO., Seattle, Washington.
Model C-L-4-S Seaplane. Two-seater Naval Training Machine.

CANTILEVER AERO COMPANY, New York.
Christmas "Bullet." One-seater monoplane.

CURTISS AEROPLANE & MOTOR CORPORATION, New York.
Model 18-B. Two-seater combat machine built for United States Navy.
Model JN-4 D-2. Two-seater training machine.
Model H.A. Two-seater combat seaplane built for United States Navy.
Model MF Flying Boat. Two-seater sport machine.

DAYTON-WRIGHT AIRPLANE COMPANY, Dayton, Ohio.
D H-4. Two-seater combat machine.
D H-K. ("Honeymoon Express.") Three-seater sport machine.
T-4. ("Messenger.") One-seater sport machine.

GALLAUDET AIRCRAFT CORPORATION, East Greenwich, Rhode Island.
Model D-4. Light bomber seaplane. Two-seater.
"Chummy Flyabout." Two-seater sport machine.

GLENN L. MARTIN COMPANY, Cleveland, Ohio.

Connecticut Aircraft Company, New Haven, Connecticut.
    Free Balloon, solo type.
Goodyear Tire & Rubber Company, Akron, Ohio.
    Caquot model R kite balloon.
The B. F. Goodrich Company, Akron, Ohio.
    B-Class Naval Airship.

AIRCRAFT ENGINES

Aeromarine Plane & Motor Company, Keyport, New Jersey.
    Type L. 6 cylinder, 130 horse-power.
Curtiss Aeroplane & Motor Corp., New York.
    Type K-12, 12 cylinder, 375 horse-power.
    Type K-6, 6 cylinder, 150 horse-power.
    Type OX-5, 8 cylinder, 90–100 horse-power.
Duesenberg Motor Corporation, Elizabeth, New Jersey.
    Type Duesenberg H., 16 cylinder, 800 horse-power.
    Type King-Bugatti, 16 cylinder, 410 horse-power.
Hall-Scott Motor Car Company. San Francisco, California.
    Type A-8, 16 cylinder, 450 horse-power.
Lawrence Aero Engine Corporation, New York.
    Type L-1-60, 3 cylinder, 80 horse-power.
Lawrence Sperry Aircraft Corporation, Farmingdale, Long Island.
    Type W. B. B. Engine, 4 cylinders, 38 horse-power.

[redacted]

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Christmas "Bullet." One-seater monoplane.

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Model JN-4 D-2. Two-seater training machine.
Model H.A. Two-seater combat seaplane built for United States Navy.
Model MF Flying Boat. Two-seater sport machine.

DAYTON-WRIGHT AIRPLANE COMPANY, Dayton, Ohio.
D H-4. Two-seater combat machine.
D H-K. ("Honeymoon Express.") Three-seater sport machine.
T-4. ("Messenger.") One-seater sport machine.

GALLAUDET AIRCRAFT CORPORATION, East Greenwich, Rhode Island.
Model D-4. Light bomber seaplane. Two-seater.
"Chummy Flyabout." Two-seater sport machine.

GLENN L. MARTIN COMPANY, Cleveland, Ohio.
Martin Bomber. Four-seater night bombing machine.

L. W. F. ENGINEERING CO., College Point, Long Island.
Model G-3. ("Shark.") Two-seater combat machine.
Model HS 2-L. Three-seater naval patrol seaplane.
Model VII-L. ("Seagull.") Two-seater sport machine.

PACKARD MOTOR CAR COMPANY, Detroit, Michigan.
Model 1-A. Two-seater sport machine.

STANDARD AIRCRAFT CORPORATION, Elizabeth, New Jersey.
Model E-1. Pursuit training machine.

[redacted]

Free Balloon, solo type.

GOODYEAR TIRE & RUBBER COMPANY, Akron, Ohio.

Caquot model R kite balloon.

THE B. F. GOODRICH COMPANY, Akron, Ohio.

B-Class Naval Airship.

AIRCRAFT ENGINES

AEROMARINE PLANE & MOTOR COMPANY, Keyport, New Jersey.

Type L. 6 cylinder, 130 horse-power.

CURTISS AEROPLANE & MOTOR CORP., New York.

Type K-12, 12 cylinder, 375 horse-power.

Type K-6, 6 cylinder, 150 horse-power.

Type OX-5, 8 cylinder, 90–100 horse-power.

DUESENBERG MOTOR CORPORATION, Elizabeth, New Jersey.

Type Duesenberg H., 16 cylinder, 800 horse-power.

Type King-Bugatti, 16 cylinder, 410 horse-power.

HALL-SCOTT MOTOR CAR COMPANY, San Francisco, California.

Type A-8, 16 cylinder, 450 horse-power.

LAWRENCE AERO ENGINE CORPORATION, New York.

Type L-1-60, 3 cylinder, 80 horse-power.

LAWRENCE SPERRY AIRCRAFT CORPORATION, Farmingdale, Long Island.

Type W. B. B. Engine, 4 cylinders, 38 horse-power.

PACKARD MOTOR CAR COMPANY, Detroit, Michigan.

[redacted]

MISCELLANEOUS

Photographic exhibit.
Gunnery, bombs, etc.

NAVY EXHIBITS

F-5-L Flying Boat. Navy patrol seaplane. This was a special display craft, one half of which was exposed to show detail construction.
Loening M-2 seaplane (Loening "Kitten") ship-plane.

The Aeronautical Exposition provided the answer to the query previously asked. From March 15th on, the Manufacturers Aircraft Association has been actively engaged in the education of the

AEROMARINE PLANE AND MOTOR COMPANY, KEYPORT, NEW JERSEY

MAIN OFFICES, AIRPLANE AND MOTOR FACTORIES, Keyport, New Jersey.

SALES AND ADVISORY ENGINEERING OFFICE, 1800 Times Building, New York City.

Officers

President	INGLIS M. UPPERCU
Vice-President	JOHN W. GERMAN
Secretary	E. DEB. NEWMAN
Treasurer	AUGUST FAUX
Manager	E. DEB. NEWMAN

Directors

INGLIS M. UPPERCU — E. DEB. NEWMAN

JOHN W. GERMAN

Airplane Division

Advisory Engineer	CHARLES F. WILLARD
Engineer in Charge, Keyport, New Jersey	PAUL G. ZIMMERMANN

Motor Division

In Charge "L" Motor Division	CHARLES F. WILLARD
Chief Designing Engineer, "L" Motor Division	R. E. LAYMAN
In Charge "B" Motor Division	JOSEPH J. BOLAND

ARMISTICE DAY, 1918, found the Aeromarine Plane and Motor Company in production on a lot of fifty Aeromarine Model 40 flying boats of a three hundred machine Navy order. As these were to have been used for training purposes, the Navy saw fit to reduce the order to the quantity in production, and the lot was completed in the early part of 1919.

Extensive experimental work was carried on during the winter with the Model 40 flying boat, resulting in some slight changes, which made it an ideal sportsman's boat. This new model, known as the 40 "C," was put in production upon the completion of the Navy contract.

In the meantime experimental work progressed on a three passenger flying boat, equipped with the Aeromarine Models "L," "B" and Hispano-Suiza motors, resulting in placing on the market the 50 type flying boat, exhibited for the first time at the 1919 New York Aeronautical Exposition. As the passengers in this model are enclosed in a sound and weather-proof cabin, it became known as the

" Limousine Boat," and created such favorable comment at the exposition that a number of orders were placed. A Model 50 was sold to the Aero Limited and used on the New York–Atlantic City Air Service Route.

After further extensive experimental work with the two passenger cabin, it was decided to try out a flying boat with the pilot, as well as the passengers, included in the cabin. This machine, while it was not placed on the market, was looked upon with much favor by the pilot and passengers on the test flights. It afforded complete protection against the elements and made possible conversation between pilot and passengers.

Realizing the demand for a machine with a multiplicity of motors powerful enough to carry a number of passengers, the construction of a twin motored, five passenger cabin flying boat was started. This machine, known as the Model 60, promises to be very successful as a passenger boat.

Although the Aeromarine Plane and Motor Company has confined its production efforts to flying boats, the land machine has not been overlooked, in an experimental way. During the year the Model

[redacted]

plans. Pilot Zimmermann with Richard Greisinger, as mechanic and operator of the mail dropping device (which had been worked out after days of careful experimenting at Keyport) started from 86th Street with the bag of mail and successfully dropped it on board the steamer at 2:10 o'clock that afternoon, one hour and forty-five minutes after the vessel had sailed.

From time to time damaged machines have been sent to the factory by insurance companies and individuals for repairs. Considerable work has been done on privately owned J. N.-4 land machines, which had either been through crashes or were in need of general overhauling.

Toward the end of the summer the air service selected various companies to rebuild D. H.-4 fighting planes into D. H.-4-B machines. The Aeromarine Plane and Motor Company was first given a contract to reconstruct seventy-five of these planes; and later the order was increased by fifty, making a total of one hundred and twenty-five. The first order was completed fully a month ahead of the contract time allowance of ninety days.

At the request of the Navy, bids were submitted for three machines [redacted]

irplane photograph of Aeromarine Factory at Keyport, New Jersey

test in actual service two types of aeromarine motors, which later were to be put on the market. .They are the Models "L-6D" and "B-8."

The "L-6D" is a direct drive, 6-cylinder aluminum block motor with a removable head, camshaft and valves being located in this head. It has shown remarkable efficiency in oil and gasoline consumption, both on the block and in flying tests. As a tried and proven piece of machinery, the "B-8" 8-cylinder, Vee engine has met with great success, it having been used in the 1918 trophy contest where it made an excellent record.

The Model 40 flying boat left Keyport, equipped with a "B-8" motor, on Monday, October 27th. The weather up to the time of starting was so foggy it was deemed advisable not to make an earlier start. The fog then lifted sufficiently to warrant beginning the flight.

The boat passed Deal Beach 25 minutes later, but ran into fog so thick it was necessary to fly entirely by compass. Later, it was decided to land in the ocean and wait for the weather to clear a bit. As an hour's wait did not improve conditions, Pilot Zimmermann again took the air and flew a course he thought would take him down [redacted]


Model 50 B

accordingly, made a safe landing in the harbor. Customs formalities finally permitted the three machines to ride at anchor under the protecting walls of El Morro castle where they created a sensation, these harbingers of the future in a city whose heart is always open to those who navigate the seas.

Pilot Zimmermann set out on the return flight in his flying boat the morning of November 19th. The return was much the same as the outward voyage, except bad weather and strong head winds were encountered, greatly delaying the flight and necessitating a stop-over in Key West, Savannah and Hog Island, Virginia, to await better weather. During the last two days of the trip, Zimmermann and Greisinger suffered considerably from cold, not being equipped for cold weather flying. This was the first round trip between New York and Havana.

Motor development, which has been under way for some years past, has progressed rapidly to the perfection of two general types of motors, the Model " L-6D " and the " B-8."

The " L-6D," a vertical 6-cylinder motor, developing 130 horsepower, has been looked upon favorably by the Navy for some time. [redacted]

Designed and built the first flying boat to carry a commercia traveler over his territory. (Model 40 "C.")

Designed and built the first flying boat, including the motor, tc complete the trip from New York to Havana, and return. (Mode 40.)

Designed and built a five passenger twin-engine flying boat (Model 60.)

Finished a navy contract for training flying boats. (Model 40.)

Designed and built three special fighting ship airplanes for the Navy. (Model A.S.)

Rebuilt one hundred and twenty-five D. H.-4 airplanes on an army contract.

Completed the experimental work on two separate types of air plane motors. (Models "L-6D" and "B-8.")

THE BOEING AIRPLANE COMPANY

PLANT — Georgetown Station, Seattle, Washington.

Officers and Directors

President	W. E. BOEING
Vice-President and General Manager	E. N. GOTT
Secretary and Assistant to the President	J. T. HARTSON

with current practise, and was known as the B. & W. model. By installing the necessary machinery in the hangar which had been built to house the Martin plane, the construction of two of these models was commenced. The first flight, with Mr. Boeing as pilot, was made on June 29th, 1916.

By this time it was found that the business necessary to the continuance of experimental work could more easily be carried on in the name of a corporation: Consequently, on July 15, 1916, the Pacific Aero Products Company was organized and the activities taken under that name. Later, on April 30, 1917, the name of the corporation was changed to the Boeing Airplane Company.

The original plant operated by the Pacific Aero Products was taken over in the spring of 1917 and consisted of one large two-story building, located on the Duwamish River, just south of the center of the city. The design and construction of the first distinctly "Boeing" plane, was carried out at the Lake Union hangar, and was followed by an extensive series of experiments on pontoon design, that ended with the successful development of a twin float landing gear which was used on the succeeding models.

Both the United States Army and Navy were quick to recognize the merits of the new Boeing plane. Experimental orders were soon placed for training machines of this type. The Type E. A. was developed for the Army and was a "Sociable Seater" training machine powered with the Curtiss O. X. X.-2, eight cylinder 100 horse-power motor. The Navy placed an experimental order for training machines very similar to the original type powered with the Hall-Scott A.-7-a, 100 horse-power motor. These machines were delivered to the Training Station at Pensacola, Florida, soon after the declaration of war, where exhaustive tests proved their adaptability to the training

[redacted]

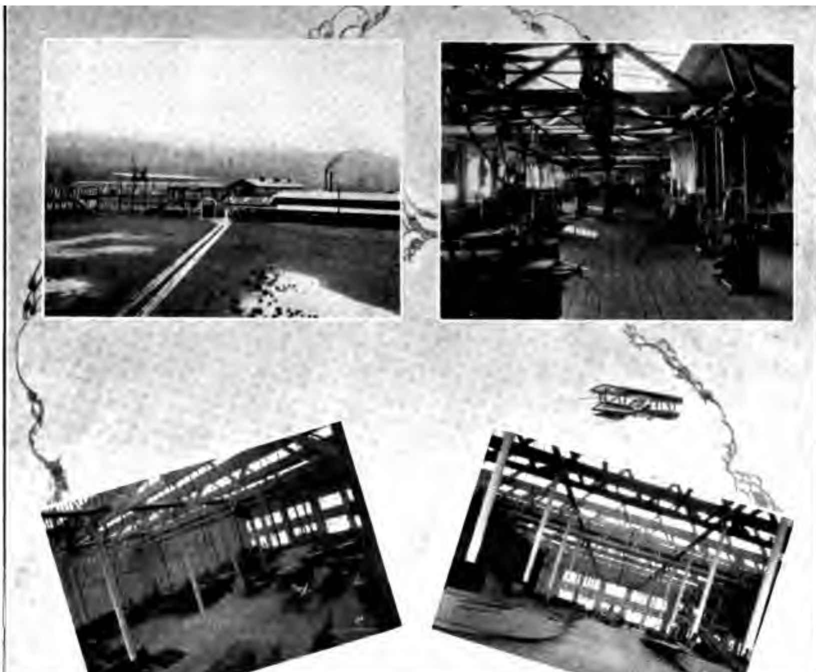
mercial Flying Boat

buildings. Throughout construction one cardinal principle was maintained. The Boeing plant was to be an ideal aircraft factory and therefore must be self-contained. All operations necessary to the construction of modern aircraft could be performed within the plant and as a result a high standard of workmanship was maintained. To build up this standard has always been the ideal of the Boeing organization.

In the summer of 1918, the contract for training planes having been completed, the Navy requested that the efforts of the company be turned to the production of the successful standardized flying boat, known as Model H. S.-2-L. This craft was used extensively for submarine patrol and coastal observation on both sides of the Atlantic. The H. S.-2-L flying boats were much larger than the training planes and made necessary the construction of additional facilities.

Pursuing the practise followed in the previous buildings, a new assembly building was completed, embodying tile mill construction. This building is 200 feet long by 150 feet wide, and has a clear floor space 200 feet long by 100 feet wide with 30 feet headroom. The farsighted policy of providing a room of this size is shown in the present tendency toward the development of exceedingly large machines, and this room is of ample size in which to assemble the super-aircraft of the next few years.

With the signing of the Armistice and its accompanying cancelations, the company was permitted to finish only twenty-five of the H. S.-2-L type. These were delivered in the spring of 1919 and embodied several changes, made at the request of the Boeing technical staff, which greatly increased the efficiency and performance of the



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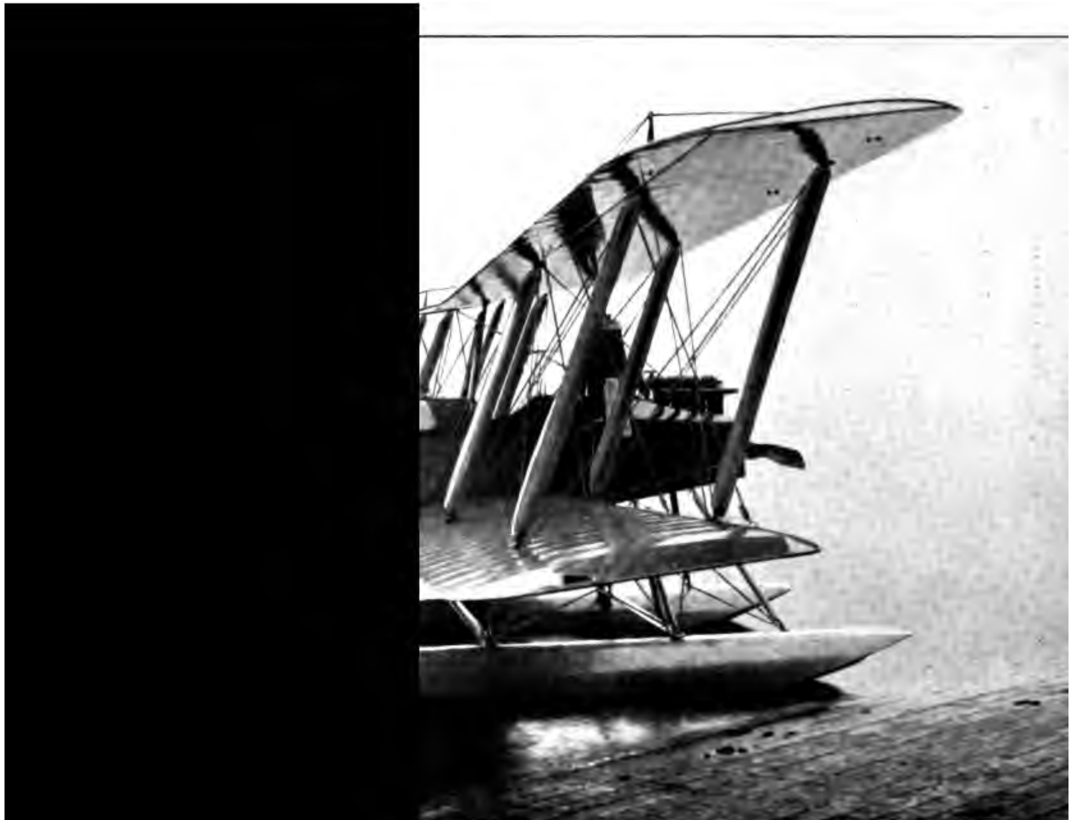
brought a wealth of practical experience the value of which cannot be overestimated.

Early in the spring of 1917, J. T. Hartson became connected with the company. Starting with the technical development, Mr. Hartson has progressed through all departments. This valuable experience is now being used to practical advantage in the executive position he now holds as Secretary of the company and assistant to the President.

The Superintendent of the Boeing manufacturing departments, C. A. Berlin, was an early and enthusiastic devotee of flying. Mr. Berlin was a member of the first Curtiss class in flying at San Diego in 1913, and subsequently gave exhibitions throughout the country, developing an excellent reputation as an exhibition pilot. His work in crystallizing the organization of the manufacturing departments cannot be overvalued, particularly in view of the increased production necessary during the war.

The early technical development was under the direction of J. C. Foley, who subsequently severed his connection with the company. During the war, John W. Miller, Professor of Aeronautics at the University of Washington, held the position of Chief Engineer, and materially assisted in the technical development during that period. The present technical staff consists of C. L. Egtvedt, chief engineer, L. S. Marsh, assistant engineer, and P. G. Johnson, production manager. The efforts of these men have been untiring and their progressive development along both technical and practical lines has kept them in close touch with the rapid advance of aeronautics.

Immediately on the signing of the Armistice, the future plans of the company took definite form. Realizing the natural advantages of the local district for the use of seaplanes and flying boats and considering the extensive experience represented by the organization in the design and construction of such types, it was decided that the [redacted]



[redacted]aval Training Seaplane

now known as C. L.-4-S and is powered with the new Hall-Scott Liberty-4 motor.

Two decidedly new developments were made, improving the war practise in flying boat construction. These types are known as the B.-1 and B. B.-1. Both types have been designated for use under the extremely hard conditions that will be experienced during the early years of commercial aeronautics. The hulls in particular representing the latest development of strength and rigidity, being of laminated red cedar, laid at 45 degrees to each other and to the center line of the boat, with fabric and marine glue between the plies. This construction eliminates the use of fins or sponsons as was common in war practise, and greatly increases the hull strength, in addition to materially reducing its weight.

The B.-1 has a wing spread of 50 feet 3⅛ inches, is powered with the Hall-Scott Liberty-6, and develops 93 miles per hour at high speed. A low landing speed of 50 miles per hour, a climb of 3,600 feet in ten minutes, gasoline capacity for five hours' continuous high speed travel, and an allowance of 560 pounds for passengers or mail, make the machine eminently suited for commercial use.

The Model B. B.-1 is similar in design to the B.-1 but somewhat smaller, being powered with the Hall-Scott Liberty-4. It has a wing spread of 45 feet 6 inches, a high speed of 86 miles per hour, a landing speed of 34 miles per hour, gasoline capacity for three hours at high speed, will climb 3,400 feet in ten minutes, and has a passenger allowance of 500 pounds. These models have found great favor in the Northwest, the former for heavy commercial work, and the

Seaplane mounted on Sea Sled

be launched into the air with full supply of gasoline and bombs. This eliminated the long flights necessary without the sea sled equipment.

Because of its high speed and seaworthiness, the sea sled is well suited to pleasure and commercial uses, and the Boeing Company is now developing the territory comprising the western section of the United States and Alaska, and the insular possessions in the Pacific.

The same interest and patriotism shown by the Boeing organization during the war is now being directed toward the development of commercial aviation in all its branches. The high standard of workmanship that made Boeing planes notably successful during that period will be maintained through future years.

The Boeing organization — schooled in the exacting requirements of war operation — will be available to the commercial user of aircraft, while the same undying faith in the future of aeronautics that led to the original formation of the company will keep it in the forefront of aeronautical development.

THE BURGESS CO.

Curtiss Aeroplane and Motor Corporation

New York City

President	J. N. Willys
Vice-President	W. W. Mountain
Vice-President	C. M. Keys
Vice-President	W. B. Stratton
Vice-President	J. E. Kepperley
Secretary and Treasurer	R. W. Moore

Directors

J. N. Willys	G. H. Curtiss
C. H. Conner	W. B. Stratton
F. H. Russell	W. W. Mountain
J. E. Kepperley	C. M. Mertz

C. M. Keys

Curtiss Engineering Corporation

Garden City, New York

President	G. H. Curtiss
Vice-President (First)	W. W. Mountain
Vice-President	F. H. Russell
Vice-President	W. L. Gilmore

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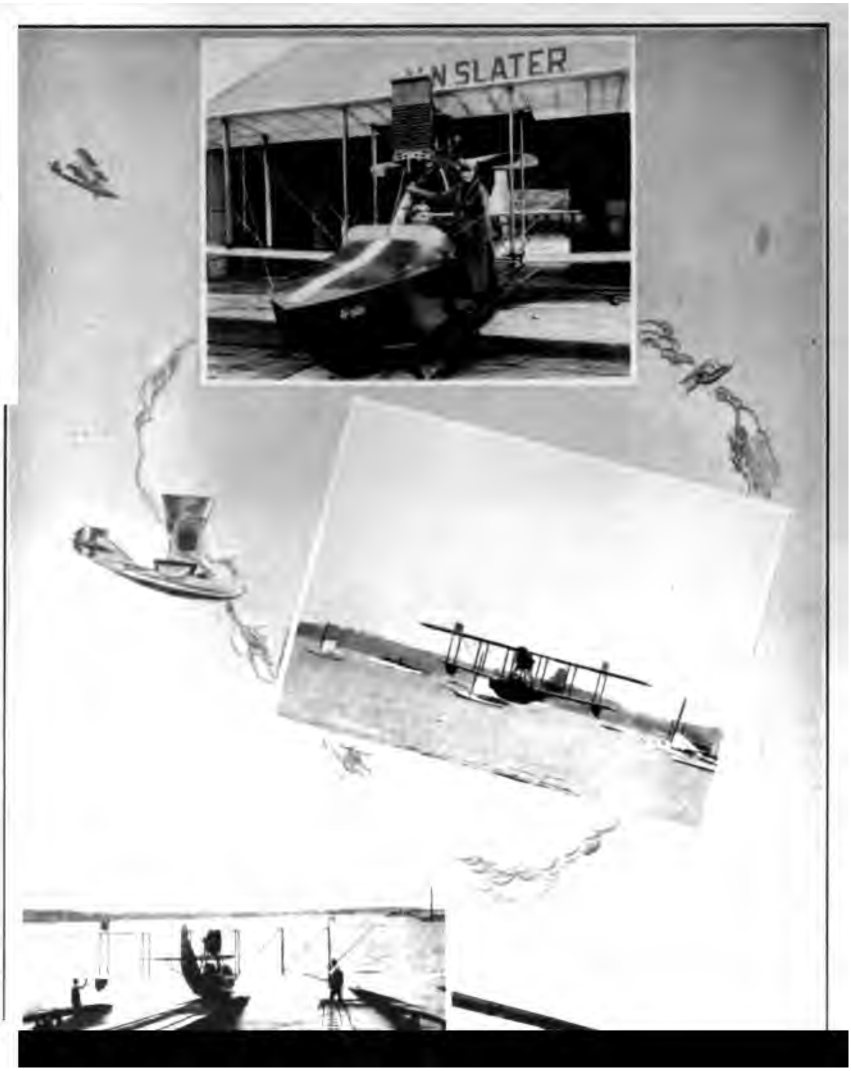
SLATER

IN the history of aircraft manlfacture November 11th, 1918, will be less important as the ending of the war than as the beginning of peace.

Particularly has this been true of the Curtiss organization with its experimental and production forces.

While better prepared than ever before to produce the accurate and progressive work demanded by military aviation, it has been extensively occupied during the last twelve months in meeting demands for commercial aeroplanes. The successful accomplishment by the Navy-Curtiss 4 flying boat, of the first transatlantic flight and the setting of new world's climb and altitude records by the Curtiss *Wasp,* link Curtiss design and production with two of the greatest scientific achievements of the year, both involving United States Navy aircraft.

On the other hand, the industrial accomplishment, if entirely different, has been of at least as great a significance. Under the direction of Curtiss Executives the severe battle plane has been transformed into the upholstered aerial limousine. The machine gun has made way for the self starter. And Curtiss production has put the [redacted]

John N. Willys and Glenn H. Curtiss, the leaders in the Curtiss corporations, believed in the immediate practicability of the commercial airplane.

ORGANIZATION OF COMMERCIAL AVIATION

Mr. Curtiss, associated with aviation since 1904, flyer of the first aeroplane to make a publicly announced flight in the United States, and inventor of the hydro-aeroplane and the flying boat, had never regarded the airplane as a purely military or exhibition machine. As early as 1913 a four passenger flying boat of his design and construction had been used by Harold McCormick to commute between Lake Forest and Chicago. Curtiss aeroplanes had carried mail as early as 1911. In 1919 Mr. Curtiss turned with full confidence to a task in which he had always been interested and which now seemed capable of satisfactory completion: the designing of special types of aircraft for practical peace uses.

Mr. Willys brought to the problem of organization for the production and marketing of these machines a long and successful experience with the automobile industry.

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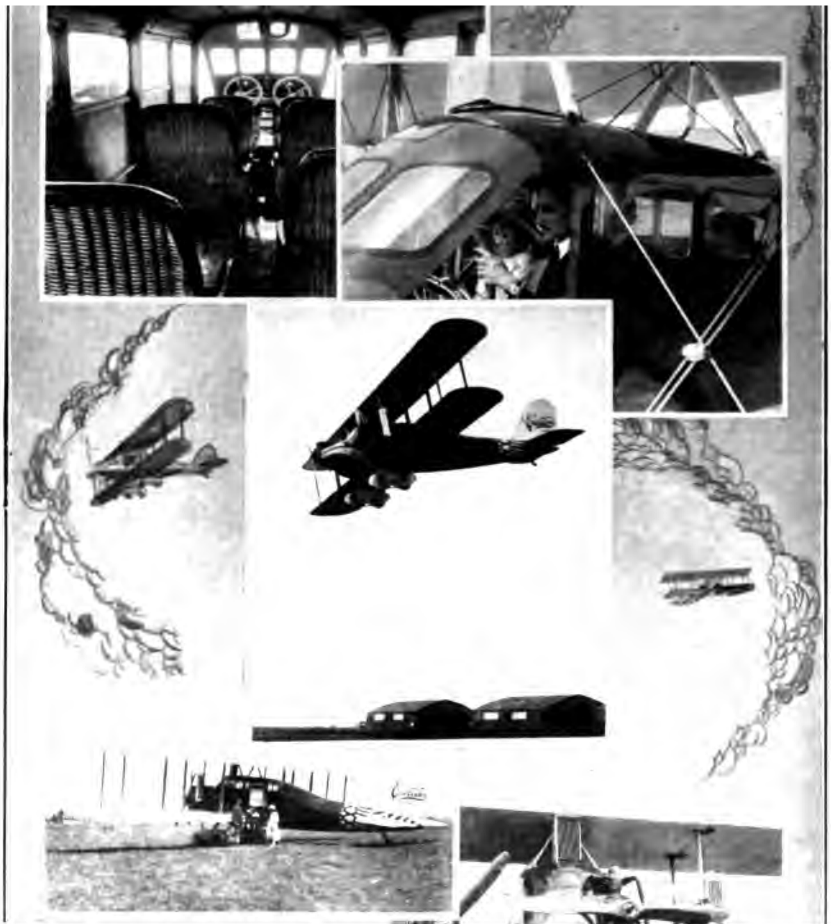

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While this preliminary work was being completed the Department of Education and Sales Promotion, as part of the Sales organization, began a vigorous campaign under Fay L. Faurote in public education through aeroplane publicity, and in advertising designed to convince the business and pleasure worlds of the immediate practicability of the aeroplane for peace time service.

On April 4th, 1919, the first commercial Curtiss flying boat left the Garden City factory,— the three passenger flying boat *Seagull.* On April 12th, 1919, was made the first flight of the first Curtiss commercial aeroplane for 1919,— the three passenger *Oriole.* It is a matter of interest that these seem to have been the first post-war commercial designs for both marine and land flying put to regular use in any country.

In appearance and performance they announced a new era. "Make it safe," and "Make it comfortable" had been the demands of the business world. The new Curtiss designs paralleled the comfort of the automobile, reduced materially the cost of operation, gave new style and stability for everyday flying, and increased the available speed of their type.

the "running board" of the lower wing into the comfortable compartment of the boat hull, where three seats were arranged for pilot and passengers. The result of a long evolution in flying boat building, the *Seagull* paralleled in small unit construction what the N. C.'s represented in larger units. Its hull, finished in mahogany planking, was sufficiently sturdy to ride rough water with safety. Employing Curtiss K.-6 motors it flew at a speed of 76 miles per hour.

TRANSFER OF GOVERNMENT AEROPLANES

With these two types ready for quantity production and the eight passenger Curtiss *Eagle* in process of construction for use as an aerial liner, Curtiss prospects for commercial flying were remarkably promising. Dealers and distributors were busy by early summer at Atlantic City, Boston, Los Angeles, San Diego, Chicago, and other cities, while the organization of new branch offices proceeded rapidly. Abroad a South American mission, composed of C. W. Webster, Lawrence Leon, and Orton Hoover, was active by July demonstrating the Curtiss *Oriole*, *Seagull*, and *Wasp*, and investigating South American aeroplane markets.

At this juncture the commercial aviation outlook was affected by

[redacted]

to accrue to the industry through the proper preparation for the market of these planes and motors by some one responsible, and the establishment of aeronautical trade on a sound basis, outweighed the difficulties to be encountered.

FOUR AEROPLANES FOR PEACE TIME FLYING

During the summer of 1919 the transfer of a number of planes was completed, but it was not until well into the fall that the government property as a whole may be said to have been put at the disposal of the Curtiss selling organization.

These army training planes, for the most past Curtiss J. N.'s, were by their design adapted to peace service. Built to withstand the hard knocks of training, they were calculated to meet the wear and tear of daily business or pleasure service. Their engines represented fuel economy. The cost price was considerably lower than that of any other high class machines put upon the aeronautical market. They offered the returning military aviator an opportunity to own and fly an aeroplane which he had grown to trust and appreciate during a

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passenger compartments and side entrance door. 2. Upper center — Oriole in flight. 3.
ollins and the Cuban representatives. 4. Mrs. S. E. J. Cox and her Curtiss Oriole. 5. Lov
W. H. McMullen. 7. View showing seating of pilot and passenger, Curtiss Oriole.

flight of surgeon to patient in the same machine by Dr. F. A. Brewster of Beaver City, Iowa, May 24th, and the intercity flight of Mrs. S. E. J. Cox and her son in a Curtiss *Oriole* from Houston, Texas, to New York City, completed October 7th without plane or motor difficulty of any sort, are typical of what has been occurring.

In the Aeronautical Convention tests at Atlantic City in May, 1919, the *Oriole* won first prizes for speed and reliability. Participating in the New York–Toronto reliability race, August 25th–29th, a Curtiss K-6 *Oriole,* piloted by Roland Rohlfs, took first prize for both reliability and speed among civilian types. Second, fourth, sixth, and eighth prizes were taken by Curtiss J. N.'s, O. X.-*Orioles,* and a Curtiss-motored J.-1 for reliability, and second and third prizes for speed by a Curtiss O. X.-*Oriole* and a Curtiss J. N.-4-D.

FIRST DAILY PASSENGER-CARRYING SERVICE

developed during 1918, together with the 400 horse-power Curtiss K.-12 motor. On March 6th, 1919, the adaptation of these motors to standardized production for commercial use was taken up by F. R. Porter as Chief Motor Engineer for the Curtiss Aeroplane and Motor Corporation. The work of the Curtiss K.-12 was done in connection with the Curtiss *Wasp* in speed and altitude flying. The 150 horse-power Curtiss K.-6 rendered continuous, successful service in both the *Oriole* and *Seagull*. Its run of 2,500 miles from Houston to New York in Mrs. S. E. J. Cox's *Oriole* without even the changing of a spark plug is unique. Other performances with which it was associated were the flight of R. W. Bubbard's *Oriole* through Oklahoma, Mississippi, and Tennessee of 1,200 miles of "absolutely satisfactory" flying, and the remarkable performance of a *Seagull* piloted by W. H. Blair for the Thompson Aircraft Company from New York to Detroit via the Hudson, Barge Canal, and Great Lakes,— 700 miles in all.

THE CURTISS WIND TUNNELS

The equipment of the Engineering Corporation for aeronautical research and experimental production had been not a little responsible for the remarkable work done on the N. C.'s, the speed machines, and the new motors. Perhaps the most important feature of this equipment was the wind tunnel building. Here three wind tunnels,—seven, four, and two feet respectively, have been in use. Most important of these is the seven foot tunnel, put in operation March 26th, 1919. Seventy feet in overall length, and from seven to seventeen feet in diameter, it is believed to be the largest wind tunnel in the world. Prior to its construction data was gathered concerning all notable wind tunnels both in the United States and abroad. Using this material as a point of departure, Curtiss designers made notable improvements in wind tunnel design over existing types. In particular the constancy of air flow was increased. The remarkably uniform velocity distribution in the air current of the new tunnel has insured an unprecedented accuracy in the measurement of wind forces.

[redacted]

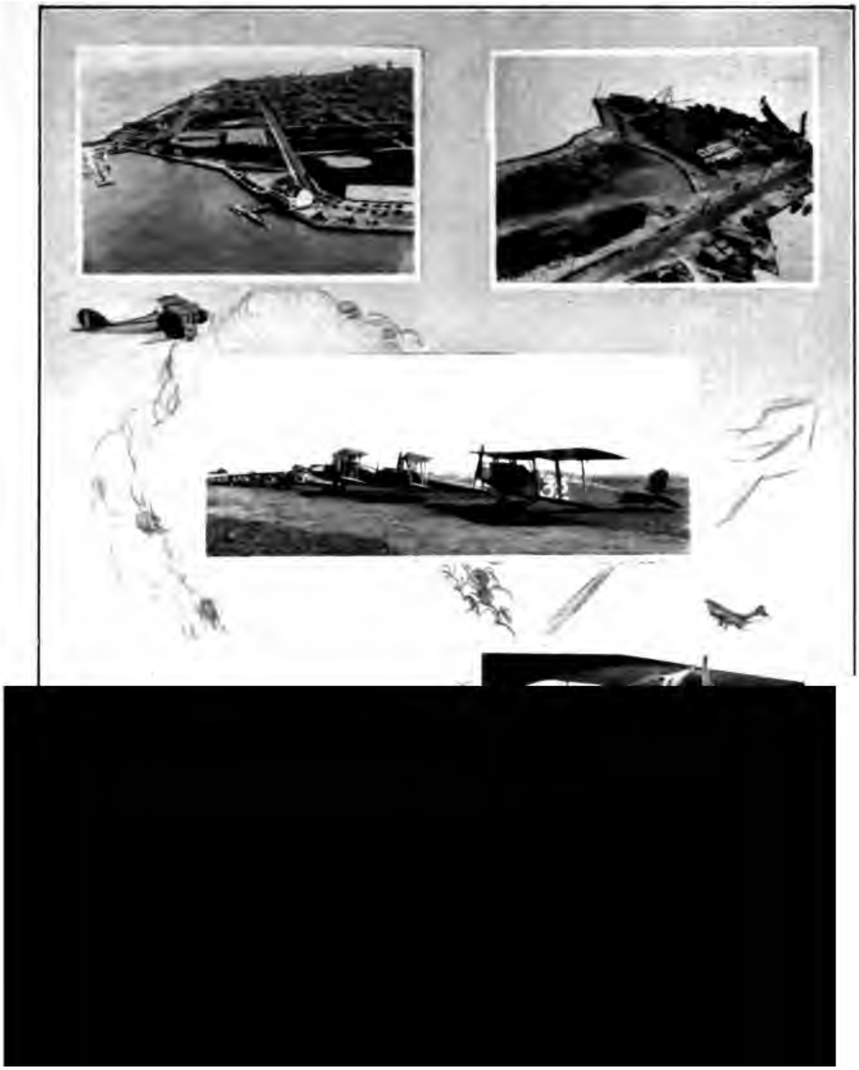
oration's Plant at Garden City, L. I., N. Y.

is determined by the action of a special propeller driven by a 400 horse-power motor. This motor is electrically controlled from the experimental chamber, and can furnish any speed desired, even to velocities approaching 100 miles per hour. These speeds are accurately measured by means of a new type of absolute pressure gauge.

The balance can record wind pressures in all desired directions to .0001 of a pound. Results are thus obtained which afford the basis for almost any knowledge touching the efficiency of aircraft. Shapes of wings can be tested for lifting capacity and for deadhead resistance. The efficiency of a fuselage shape can be determined. The pressures on the aeroplane in any position can be recorded. Stability, head resistance, action of rudder and elevator, behavior of streamline wires, air driven gasoline pumps, etc., become no longer matters of doubt, for they can be settled in the laboratory preliminary to any field work. As a result new Curtiss machines perform like seasoned types, showing that the aeroplane has been reduced to a problem like the railroad bridge, and solved in laboratory and factory preliminary to its first actual use.

TESTS FOR AEROPLANE MATERIALS

Another important part of scientific equipment used by the Curtiss Engineering Corporation was the Chemical and Metallurgical Research Laboratory. Here tests on wood, metal, "dope," cotton, etc., were scientifically carried out. Exact knowledge was made possible of the quality and hence the performance of every part of the aeroplane. This, checked against the stresses as figured from the wind tunnel data, insured a high factor of safety in Curtiss machines which made their construction as reliable as the scientifically erected bridge



by underground conduits, a stock room and a machine shop are part of the equipment. All gasoline, oil, etc., employed in laboratory work is scientifically weighed and results to date show that absolutely accurate tests for power, consumption, etc., can be run.

FIRST FLIGHT ACROSS THE ATLANTIC

In January, 1919, the N. C.-2 has just made way on the floor of the N.-C. extension of the Garden City plant for the N. C.-3. This flying boat with its sister the N. C.-4 required the work of 800 Curtiss men and women until late in April. It is now well known that the United States Navy decided late in 1918 to employ these gigantic flying boat bombers in the cause of science. The first flight across the Atlantic, May 16th–31st, 1919, is a story that any schoolboy can tell. It is a tribute to the bravery and the skill of United States Navy fliers. It was also an indication of the possibilities of commercial aviation. Coming at the beginning of the first year of peace, it showed the scientific progress which the aeroplane had made during four and a half years of war. It also revealed the skill at the disposal of The Curtiss Companies in conjunction with the naval constructors. The N. C.'s were, indeed, an index to the character and accomplishment of Mr. Curtiss. Since his development of the seaplane in 1910–1911, Mr. Curtiss had led the world in hydro-aeroplanes and flying boats. It was significant that he should be asked to cooperate with government engineers in 1917 in the designing of the largest heavier-than-air craft built for the United States Aviation Service during the war, and the first aeroplane to cross the Atlantic.


OFFICIAL
BAROGRAPH RECORD - ALTITUDE FLIGHT - SEPT. 18TH 1919. ROLAND ROHLFS PILOT.
CURTISS ENGINEERING CORPORATION, GARDEN CITY - T.822.

in the short time in which they have been in use.

The HA hydro-aeroplane was another type built during the year 1919. It had already been given trial flights in the early part of the year, showing a speed of 131 miles per hour with full load, the fastest rate of travel recorded for a seaplane. Three of these Curtiss designs were delivered to the United States Navy between April and July, 1919.

A number of aeroplanes and flying boats were also constructed for the Navy in quantity. A new navy type of flying boat, the H. S.-3 long distance bomber of 74 foot wing span — was delivered in quantity between May 17th and August 1st. Between the signing of the Armistice and the end of January, seventeen H.-16's — flying boats of 96 foot wing span — were also completed.

DEVELOPMENT OF THE WASP

With the exception of the N. C.'s, however, none of these types represented such progress in aeronautical design for the purely scientific and military purposes as the Curtiss *Wasp* and the Curtiss *Hornet*.

Curtiss executives have always considered speed to be the prime characteristic of the aeroplane. As speed rates shot to 75, 90, 100, and even 140 miles an hour they were still convinced, as they are to-day, that the limits of aircraft with regard to velocity had by no means been reached. During the war they had initiated work upon a speed plane both in triplane and biplane form. The former had been tried out July 5th, 1918, with success, but refinements designed to increase an already remarkable performance delayed tests on the final machine until the spring of 1919. In flights made at this time by Roland Rohlfs a speed was achieved of 162 miles per hour with-

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A NEW WORLD'S ALTITUDE RECORD

Three altitude flights were made by Pilot Rohlfs with this machine. All three were made with standard fuels and without special plane or motor accessories. The first, July 30th, 1919, set a new American altitude record of 30,400 feet. In absence of verification of Lieut. Casale's mark of 33,100 feet claimed on June 14th, at Villacoublay, France, this seemed also to be a world's height mark. Rohlfs followed this flight, which he considered unsatisfactory, with a second though unofficial flight on September 14th. On this occasion he ascended to an elevation of 34,200 feet. On September 18th, he made his third attempt. In the presence of government, Aero Club, and Curtiss officials he left Roosevelt field to reach an elevation of 34,910 feet, or 90 feet less than the design ceiling of the machine.

"Did it this time, all right," was his first words on reaching the ground.

As Lieut. Casale's altitude was read from a barograph uncorrected for temperature, in accordance with European practise, the reading from Rohlfs' barograph of 34,910 feet, as calibrated by the U. S. Bureau of Standards, is the only one which can be compared with it

tors on the sides instead of the front of the fuselage, and enclosure of all control wires, cut down head resistance to a remarkable degree.

W. L. Gilmore, chief aeronautical engineer, is in charge of research, design, and experimental production. Mr. Gilmore has been identified with Mr. Curtiss in the development of many Curtiss aeroplanes, and is prominent as a marine engine and boat designer.

While working as an experimental unit under the direction of the Curtiss Aeroplane and Motor Corporation on the problems of peacetime aviation, the Curtiss Engineering Corporation plans to continue the more strictly scientific development of aeroplanes, hydroaeroplanes, flying boats and aeronautical motors.

III

The designing of an aerial liner which could be used as the transportation unit in regular passenger carrying lines had been one of the first projects to which Curtiss executives had given their attention early in 1919.

Their conception of the practical aeroplane for commercial passenger carrying was finally manifested in the plans for an eight passenger machine with an enclosed passenger cabin and a power plant of three Curtiss Six motors. Leaving the factory on July 24th, it soon proved that its contribution to commercial aviation would be highly important. Without sacrificing anything of the comfort and security which its builders had in mind, it developed a speed of 99 miles per hour, proved an ability to maintain altitude on two motors and showed a cruising radius from 350 to 475 miles.

AN AERIAL LIMOUSINE

"The ladies in our party," says Laurence La Tourette Driggs, President of the American Flying Club, "were particularly enchanted to discover that they did not have to remove their hats, and that the pressure of the wind did not even disturb their hair!" Passengers conversed with one another, walked about from seat to seat, and watched the world go by beneath convinced that commercial aviation, with the highest speed and the smoothest roadbed in the world, had arrived in a tangible and thoroughly practical and delightful form.

PRACTICAL DEMONSTRATION AT WASHINGTON

The flights of September 27th were followed by a number of others. So reliable was the *Eagle* that it was decided to fly it, together with three Curtiss *Orioles,* to the national capital via Philadelphia. Here it would be possible to make demonstrations with both machines which would bring to the attention of Congress and other representatives of the United States as well as of foreign governments, the year's progress in practical aviation.

On October 24th, accordingly, the *Eagle*, piloted by Bert Acosta, left for Washington with three Curtiss *Orioles* and two Curtiss

This is the story of Curtiss planes during the year 1919. They have made for both scientific and commercial development. They represent a great beginning in a new activity, a new industry.

Great as the success of practical aviation has been this year when measured by public expectation, its immediate future is far greater. Curtiss factories at Garden City and Buffalo are supplemented by Curtiss Flying Stations at Buffalo, Atlantic City, New Jersey, Newport News, Virginia, and Miami, Florida. New Curtiss dealers and distributors are being established. Existing Curtiss distributors are already establishing sub-distributors. The work of the year has also included the establishment of a large number of landing fields — not only fields for the use of every one of the twenty-five Curtiss companies, but municipal fields as well, which these companies have been instrumental in establishing. The coming twelve months will undoubtedly see an even more rapid development of commercial flying than has been witnessed during the last eight.

THE BURGESS COMPANY

AMONG the most important preparations of the American Navy against German submarines was the construction of a number of airships of new design. These C machines are acknowledged to have been an important contribution to naval aeronautics. At the signing of the Armistice in November, 1918, the Burgess Company of Marblehead, Massachusetts, was busy completing a number of cars for these balloons.

The war work of the Burgess Company had been varied. Among other work it had constructed about 400 N-9 training seaplanes with 100 sets of spares. The last of these machines and ten of the airship cars, were completed in Plant No. 1; the production plant, No.

airships may be attributed partly to the low head resistance of the car, designed by navy constructors and produced, with some suggestions as to design details, by the Burgess plants. The airships were designed for convoy and coast patrol service and have done excellent work. The C.-5, in its flight of 1,175 statute miles from Montauk Point, Long Island, to St. Johns, Newfoundland, June 14th–15th, set an American airship endurance and distance record.

On December 15th, 1919, Mr. W. Starling Burgess retired from the Burgess Company. Frank H. Russell, President of the Burgess Company, became Vice-President and General Manager of the Curtiss Engineering Company of Garden City, Long Island.

The company having finished all war contracts, has now closed its plant awaiting a definite government policy with regard to experimental aviation.

DAYTON WRIGHT AIRPLANE COMPANY

EXECUTIVE OFFICES, Dayton, Ohio

OFFICERS

Chairman of the Board . . . . H. E. TALBOTT

The inadequacy of landing fields in this country made necessary the design of planes with a greater touring range. The use of unsightly "flying togs" so necessary in open planes with the necessity of exposure to all sorts of inclement weather prompted Dayton Wright engineers to develop the closed airplane. The result has been satisfactory and it is the intention of the company to place upon the

on Cruiser

Vright Airplane Company.

Cruiser. This plane has many of the characteristics of the D. H. 4. It is of the ordinary open type and is designed to carry a pilot with one passenger. This plane was designed primarily for government purposes and is equipped with a Liberty motor. Important changes which have been embodied in this craft from the original De Haviland design is the placing of the gasoline tank ahead of the pilot instead of between the pilot and the passenger, the new position of the tank being directly over the landing gear. The increased radius of action of nine hours in comparison with the usual De Haviland of four and a half hours adapts this plane particularly to long distance flights. In this plane, the trip from New York to Chicago may be undertaken without the necessity of stopping for fuel.

The commercial development of the company has been in keeping with their policy on furthering aviation on a sound and practicable basis. The conservative engineering policies pursued by the Dayton Wright Company during the past year have had the continued supervision of Orville Wright and C. F. Kettering.

During the past year, in addition to the previously described development work, the Government has placed with the Dayton Wright Company orders for a number of planes of special military types. Among these is the model D. H.-4-R. This model is a modification of the regular D. H.-4, with the following changes:

- Pilot's and Gunner's armament removed.
- Complete dual engine control.
- Complete dual instrument board.
- Complete dual stick control.
- Gunner's stool changed to Pilot's type.
- Gunner's cowling and after deck made round instead of regular D. H.-4 type.

[redacted]

country. The question of expense in the development of such fields actually is quite small in relation to the importance which it bears toward national aeronautical progress. The matter of large amounts of money expended in the construction of such fields is somewhat of a fallacy. What pilots most desire, is a chain of fields throughout the country, selected with a view as to natural smoothness, with proper facilities for taking on oil and gas, and housing of planes over night, when necessary. The use of good judgment in the selection of such fields is essential inasmuch as it quite frequently occurs that a smooth landing field will exist in a location which is entirely surrounded by trees, telegraph wires, buildings or such other obstructions as detract from otherwise satisfactory characteristics of the field.

GALLAUDET AIRCRAFT CORPORATION

GENERAL OFFICES, No. 30 East 42nd Street, New York City

FACTORY AND ENGINEERING DEPARTMENT, East Greenwich, Rhode Island

Chairman, Board of Directors . . . . E. F. GALLAUDET
President and General Manager . . . . . J. K. ROBINSON, JR.
Vice President . . . J. C. CRAWFORD

[redacted]

Graduating from Yale with degree of A.B. in 1893, and from Johns Hopkins with degree PH.D. in 1896, he still clung to his study of aeronautics. A few years later he went to Yale University as instructor in physics. It was while filling this position that he devoted his spare time to experimenting with the warping wing principle, attaining considerable success.

But his efforts were frowned upon by the authorities at Yale and he was notified that he would have to discontinue the experiments or resign, as (to use their phraseology) he was making an ass of himself and a laughing stock of the faculty with his "flying jimcracks."

Faltering for the moment he discontinued his efforts and allowed others who had entered the field to out-distance him in the evolution of this particular principle.

The spirit of aerial flight being strong within him he soon bravely cast aside the pedagogic fetters and entered the aeronautic arena as a pioneer. Resigning his position at Yale, he in company with his brother Denison, began the practical construction of airplanes.

In 1911 E. F. Gallaudet obtained an American Pilot's license with the Wright Brothers and the same year went to France to study continental methods in construction and actual flying, obtaining the French Pilot's license with the Nieuport monoplane in November, 1911.

Returning to this country, Mr. Gallaudet and his brother, in 1912, built the A-1 or the Bullet as it was popularly termed; a monoplane equipped with a 100 horse-power Gnome motor and having a wing spread of 32 feet, total wing surface 210 square feet and measuring 21 feet from nose to tail tip.

square feet, length from nose to tail tip 25 feet. Gallaudet Tractor, C.-2, 1915, with 100 horse-power Gnome motor. Wing spread of 34 feet, total wing surface 350 feet. Length 25 feet. Gallaudet D.-1 Twin-motored Seaplane 1915–16. D.-2 Twin-motored Seaplane, 1917, and D.-4 Liberty-motored Seaplane, 1918.

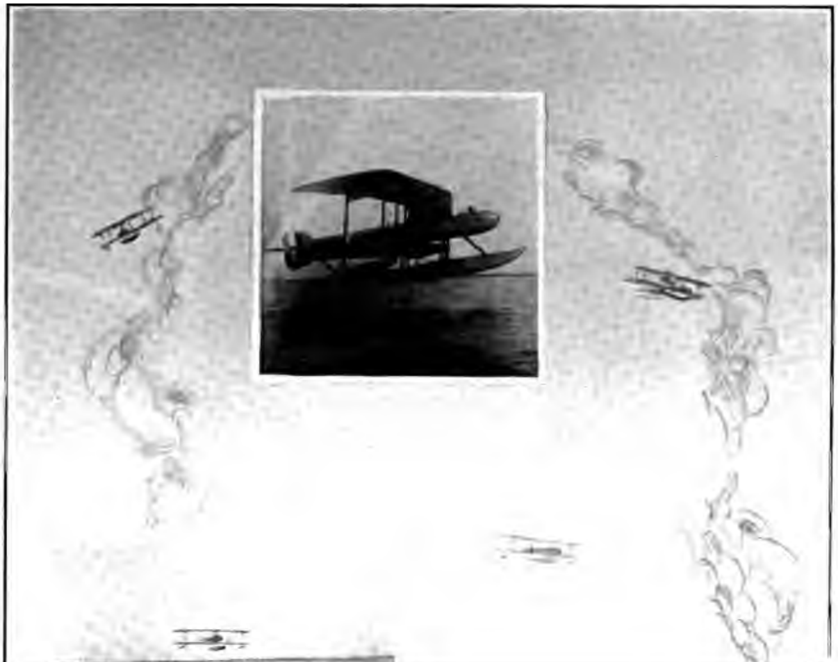
Possibly the most interesting of Mr. Gallaudet's innovations in aeronautical development is his geared propelling mechanism. To illustrate this we quote from the speech of Lieutenant Commander C. A. Read, who made the Trans-atlantic flight in the N. C.-4.

At the welcome home banquet given by the American Flying Club at the Hotel Commodore, New York City, July 2nd, 1919, Commander Read said:

> . . . we have a lot ahead of us. It has been demonstrated that the geared motor is the thing for seaplanes particularly . . . The motor is most efficient when it is going the fastest and a propeller is most efficient when it is going slowly. And in that connection, one of the future developments of importance — which Mr. Gallaudet has already shown us — is the hitching up of more than one motor to a single propeller.

The Gallaudet Engineering Company intended for consulting engineering work was organized in 1908 and re-organized into the Gallaudet Company and again in turn into the Gallaudet Aircraft Corporation in 1917 with Mr. J. K. Robinson, Jr., as President and General Manager.

Incorporated under the laws of the State of New York, January 19th, 1917, the factory was completed and ready for occupancy in May of the same year, at which time operations were started with orders on hand for four big land machines for the United States Army and two still larger water machines for the United States



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In January, 1918, this corporation accepted a contract from the United States Navy for H. S.-2 Flying Boats and the production of these boats reached its high point in September of the same year.

The present activities of this corporation are devoted to the fulfillment of several new Army and Navy contracts and the promotion of Aerial Transport in general.

It also operates as a subsidiary, the Gallaudet Aviation School, Inc., which during the early stages of the recent hostilities trained a large number of young men for the Aviation Corps, several of whom made enviable records at the front.

J. K. Robinson, Jr., who is a member of the Board of Directors of the Manufacturers' Aircraft Association and to whose guiding hand, untiring efforts and vigorous personality a large share of the success of the Gallaudet Aircraft Corporation is due, has been interested in aviation since the first heavier-than-air machine made its flight.

Born in Akron, Ohio, he received his primary education in Chicago, Illinois, and later attended Twyford at Twyford, England, finishing his education at St. Paul's School, Garden City, Long Island. His first business experience was with the Diamond Match Company of Chicago. For a period of years he was first, secretary and then President and general manager of the Carrara Paint Company of Barberton, Ohio.

In 1905 he was elected president and general manager of the Ox Fibre Brush Company of New York City, and Frederick, Maryland, and is still serving in that capacity.

He was attracted to aviation originally through his deep interests in sports. This began as early as 1898 when the "Winton One" which he drove, was considered the last word in motor cars.

He is also a yachting enthusiast, having owned several crafts, the [redacted]

Manager and later was elected Secretary of the Corporation. In 1909 he managed the Royal Brush and Broom Company of Toledo, Ohio. Later he spent several years in the Palmetto Fibre Industry in Florida.

As an expert accountant and an ardent student of finance and business methods, Mr. Lebherz was given opportunity in the Gallaudet Aircraft Corporation to display his splendid qualifications in the installation of an accounting and business system that was highly commended by United States Government officials who were in touch with the situation during the war.

John G. Crawford, vice president and factory manager, is a native of Ireland. He was educated in Scotland and in Ireland and became assistant engineer and chief engineer respectively of the old city of Dublin electric lighting plant.

In 1893 he became connected with the Thompson-Houston Electric Company of Lynn, Massachusetts, and later, went with the Gen-

THE L. W. F. ENGINEERING COMPANY, INC.

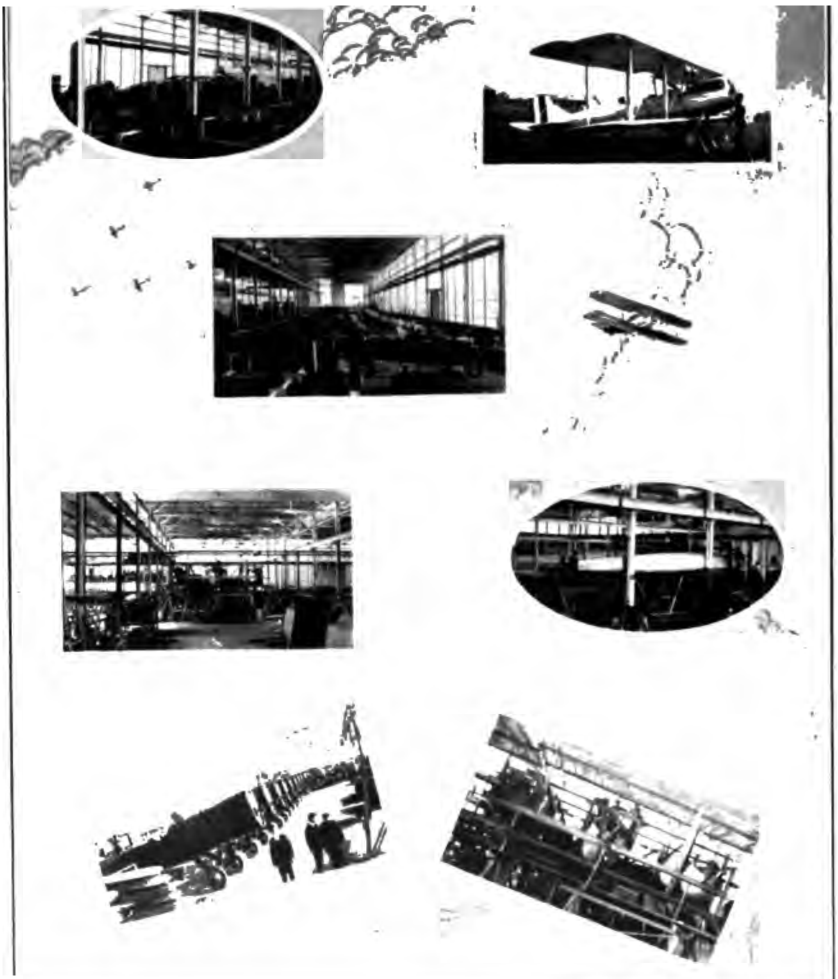
COLLEGE POINT, LONG ISLAND, NEW YORK

Officers

President . . . . J. M. FITZGERALD
Vice-President and General Manager . . . . . . A. H. FLINT
Secretary and Treasurer . . . . W. N. BENNETT

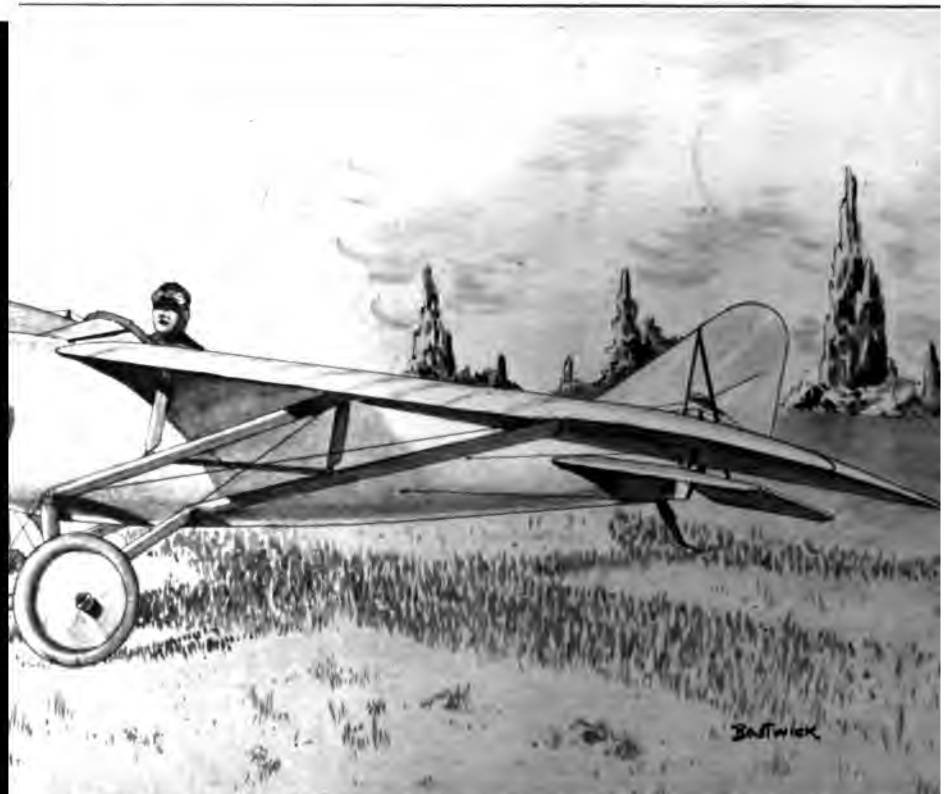
WHEN one thinks of the United States Aerial Mail — and since the war the air mail has been one of the main activities for the flying machine — naturally one thinks of the L. W. F. Engineering Company at College Point, Long Island, New York. For the L. W. F. Company has been particularly active in providing airplanes suitable for the transportation of the mails, and has developed one of the first all-American aerial freighters.

Otto Praeger, Second Assistant Postmaster General, as chief of the aerial mail service, desired to increase the scope of his department when hostilities ceased. The New York-Washington aerial mail route was operating successfully. The New York-Chicago service has been begun with equal success. Plans for a more extensive serv-



Early in 1918 the service had several of these planes on hand. They were DeHaviland-4's, single motored, two seater biplanes. The L. W. F. Company which already bore a reputation for quick delivery and accuracy of workmanship, was entrusted with the task of remodeling these craft.

Perhaps there was another reason for assigning the work to the L. W. F. It may be that when Mr. Praeger and Mr. Flint conferred on the requirements of a mail plane, the chief of the air mail realized that the engineering staff of the L. W. F. Company could proffer suggestions and design improvements to the ultimate good of the aerial mail. Most of these engineers had been retained and were working on the problems of developing a strictly commercial airplane from the military type of flying machine. Then there was Joseph L. Cato, also a member of the L. W. F. engineering staff who was developing a single seater monoplane with a view to creating a popular sporting machine having slow landing speed, quick get-away and ease of control, together with the maximum of inherent stability.



L. W. F. "Butterfly" Sport Plane

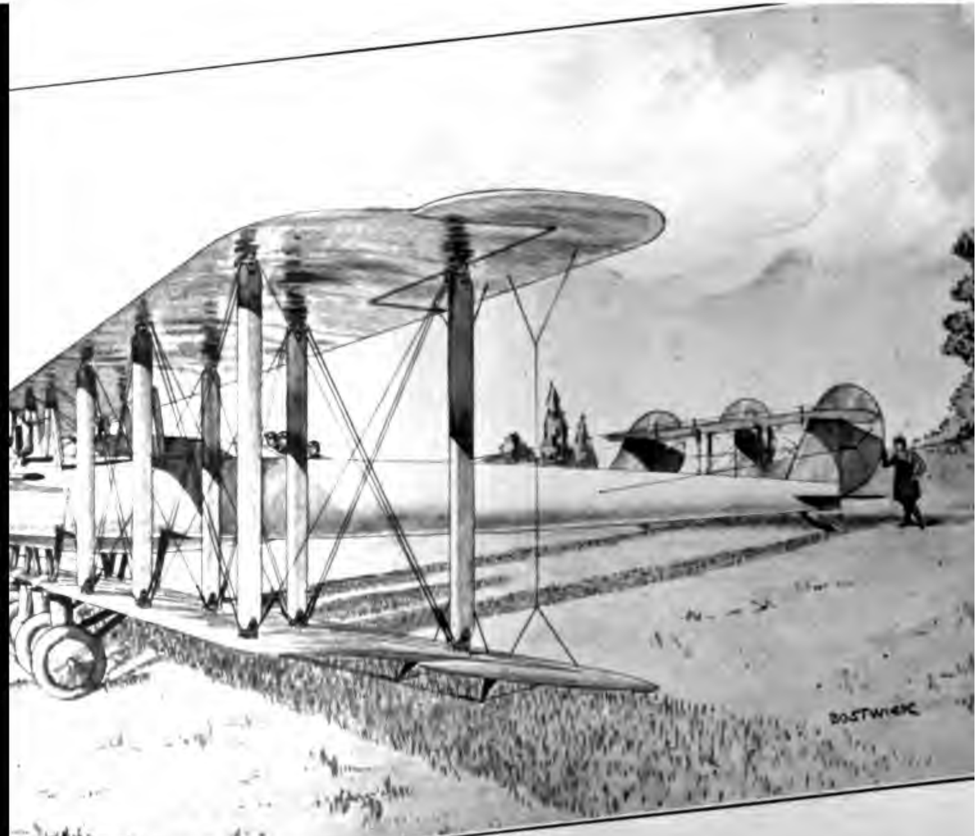
of 1916, was known as an airplane factory, not as a foundry or machine shop turned into an airplane plant overnight.

The plant has been developed to make airplanes. Every department created especially for the skilled work on planes. To-day the floor space covers five city blocks.

So, Mr. Praeger thought himself justified in interesting the L. W. F. Company in mail planes. To rebuild the DeHaviland-4's into commercial machines required numerous changes in construction. Fifty of these planes were thus made over. From reports on the performance of the D. H.-4 as a battle plane structural changes were made to decrease the tendency to nose over on landing. The machines were rebalanced and strengthened throughout and a fire extinguishing system installed, protecting both pilot and cargo.

There has been no accident with these fifty remodeled planes since they entered the postal service. A mail compartment holding more than 400 pounds of mail was installed in front of the pilot who was transferred from the front cockpit to the rear. Additional fuel capacity increased the cruising time to four hours.

A military criticism of the DeHaviland-4 was based on the position of its gasoline tank, which was between the two cockpits an [redacted]



L. W. F. Aerial Freighter

oping a sporting machine realized that, for the present, the big cargo-carrying machines are equally important, that on the practical cargo-carrying plane depends the extent to which the Government, excepting the military, will be able to utilize the airplane.

It was with considerable faith, therefore, that the L. W. F. Company accepted a contract to build commercial land tractor biplanes, to be used by the aerial mail service on long hauls, such as the one-stop mail flight between New York and Omaha. The machines are characterized as among the first aerial freighters and are designed to carry mail, express or light cargoes.

These L. W. F. aerial freighters will carry from 3,000 to 6,000 pounds cargo. At the time of their construction at the plant of the L. W. F. Company they were the largest all-American land airplanes, and their development marked a new step in aerial transportation.

On the long distance flights, such as the New York-Omaha route, with the one stop at Chicago, they carry 3,000 pounds of mail each. On shorter flights, such as from New York to Buffalo, when the quantity of necessary fuel is considerably reduced, the big ships carry

L. W. F. Two-Motored D. H. Mail Plane

an hour. They will climb about 10,000 feet in 18 minutes, while their ceiling is 17,500 feet. The endurance, or flying radius is 10 hours.

These machines are equipped with the radio plant which enables the pilot to make his way through rain, storm or fog, and to determine the exact location of the landing field when he desires to descend, though the earth is obliterated by fog.

During the last year the L. W. F. Company has redesigned several DeHaviland planes, installing two motors instead of one. Cargo capacity was increased from 400 to 800 pounds, landing gear changed to bear the additional weight and three rudders instead of one.

Captain Jack Foot, chief test pilot for the L. W. F. Company, was most successful in Washington when he demonstrated the first of these rebuilt twin Hall-Scott motored machines in November, 1919. So satisfactory were the tests and exhibition flights that the machine was at once accepted by the Aerial Mail Service.

The immediate success of this twin-motored DeHaviland is shown by the following despatch from the Washington correspondent of the

"It eliminates the fire hazard," said Otto Praeger, the Second Assistant Postmaster General, "by having the engine in the wings and away from the gasoline supplies, and also minimizes danger to the pilot for the same reason."

With its record for turning out airplanes of new and practical design, or remodeling other machines according to the demands of the service, the L. W. F. Company is prepared to fill all orders in the quickest possible period of time. Improved facilities at its factory and exhaustive study on the part of the L. W. F. engineers have made possible the rapid development of aerial freighters, the machines on which officials of the company are depending to fill the transportation needs of the future when the saving of time becomes the chief essential in American trade and commerce.

THE GLENN L. MARTIN COMPANY

CLEVELAND, OHIO, 16800 ST. CLAIR AVENUE

Officers and Directors

President and General Manager	GLENN L. MARTIN
Vice-President	CARL N. OSBORNE
Secretary	W. D. TURNER
Treasurer	S. LIVINGSTON MATHER

M. B. JOHNSON

ALVA BRADLEY

Just as November 11th, 1918, found the Martin Bomber in the limelight by reason of its remarkable performance in official tests, so November of 1919 found the plane still in the forefront by reason of its outstanding success in actual performance. One year of active usage, carrying heavy loads over long distances brought out and emphasized the qualities in the design and workmanship on the plane and it stood at the end of a year of service the one type of airplane used by the Government which had not been superseded by some other model. Cross country work of hazardous nature was undertaken by the bombers and the many long successful journeys between large cities brought out plainly the commercial possibilities of the big twin-engined ship.

When the cessation of hostilities put an end to the army program, part of which called for a large order of Martin Bombers, the Air Service then awarded the Glenn L. Martin Company a contract for four of the ships to be delivered on completion of the six which were then well under way. The completion of this order of ten planes for the Army found the Cleveland company well started on an order of six mail planes for the Aerial Mail Service and at the termination of the post office order the preliminary assembly of the first of te

[redacted]

ability to carry heavy weight and slow landing speed. Mr. Martin's organization, which had been building aircraft exclusively for eight years, bent to the task and brought out the first all-American airplane designed for war purposes, American in conception, design and workmanship and built around the 400 horse-power Liberty motor, two of which supply the power for the Martin *corps d'armée* plane. The first of these machines was flown at the Cleveland plant in the latter part of August, 1918, and during September and October underwent tests at Wilbur Wright Field at Dayton, Ohio. During these tryouts the plane showed such remarkable performance that the army officers in charge of the tests determined to try it out with bombing equipment and the flights under heavy load were so satisfactory that it was decided to convert the plane into a night bomber.

Martin Twelve Passenger Army Transport

No. 8 was accordingly fitted up with gasoline tanks carrying over two tons of fuel, sufficient for 1500 miles of flying. This plane was to be used in the first attempts to set a genuine transcontinental record, the plans calling for an initial jump from Mineola, Long Island, to North Platte, Nebraska, and a similar jump on the second day from North Platte to San Francisco. After considerable testing at Cleveland and at Dayton everything was in readiness and a non-stop flight of 635 miles from Dayton to New York was made in 6 hours and 40 minutes. Unfortunately, two days after its arrival at Mineola a hurricane struck the field, wrecking a number of airplanes and hangars. The steel hangar in which the transcontinental plane was housed, collapsed and the girders, which fell on the Martin, damaged the wings to such an extent that the Army had to abandon the proposed flight

Martin Mail Plane with trap doors open

speed and climb. It was shown that the ship was capable of extremely high speed at high altitudes. Approximately two miles a minute with full load was maintained demonstrating the possibilities of a plane of this type for the rapid transportation of machine gunners or other troops to threatened points.

The six Martin twin-engined planes built for the Post Office Department for use in the Aerial Mail Service are similar in general design to the types built for the Army. The specifications and dimensions are in the main identical as is the performance. The planes carry six hours of fuel, a crew of two and 1500 pounds of mail, the latter divided among five compartments, four of which are fitted with trap doors operated from the pilot's seat. These doors greatly facilitate and speed up the unloading of the plane when it reaches its destination and in addition are so designed that they may be used for the purpose of dropping the mail while in flight in case the postal authorities should desire to deliver portions of their cargo by this method.

An additional feature attracting a great deal of interest is a very

[redacted], Martin Mail Plane, First of the Post Office's fleet for New York-Chicago service.

the Glenn L. Martin organization to produce commercial aircraft of a superior quality. With an eye to the future, the Glenn L. Martin Company during the war designed a type of airplane whose general characteristics and qualities were similar to those demanded of a commercial airplane. The combination of safety, speed, steadiness, strength and controllability so necessary in the *corps d'armée* and bombing type of military planes formed exactly the same combination of qualities called for in the airplane of commerce so that the experience gained during the war served to develop the Martin Commercial Airplane. In other words the Martin passenger, freight and mail carrying airplane is not in any sense of the word an experiment but is a pedigreed product with actual performance to its credit.

Long cross-country trips by Martin Bombers and Martin mail planes have definitely established the ability of this type of plane to link the important centers of the United States by aerial transportation. Martin twin-engined airplanes have flown over long distances carrying as many as twelve passengers and as much as a ton of dead weight. The ton mile efficiency of the Martin twin-engined [redacted]

relationship between Mr. Martin and the United States Army came in June, 1913, when the first plane was made and delivered from the Los Angeles plant. The following year found increased orders and Mr. Martin delivered military planes to both the Holland Government and the Netherlands East India Government. The first Martin plane for the United States Army proved a success and the relationship between the Martin organization and the Army has continued.

Mr. Martin is a pioneer flyer, having built his first airplane in 1908 and taught himself to fly. Every year saw a new model, with marked improvements, and with which Mr. Martin traveled thousands of miles — the beginning of the development and establishment of an individual group who have widened and improved the types to a great degree.

Mr. Martin began, as early as 1912, to surround himself with men of marked ability in their various specialized positions in his company, and have cooperated to carry out his ideas for superior aircraft

STURTEVANT AEROPLANE COMPANY

The offices of the Sturtevant Aeroplane Company are now located in Framingham, Massachusetts, having been removed from Jamaica Plain during March, 1919.

Officers

President	NOBLE FOSS
Vice-President	BENJAMIN S. FOSS
Treasurer	W. EMERSON BARRETT
Clerk	HORATIO ALDEN

Directors

NOBLE FOSS	E. B. FREEMAN
BENJAMIN S. FOSS	NEAL RANTOUL
W. EMERSON BARRETT	GALEN STONE
WILLIAM A. GASTON	

. . . . JOHN J. MCELROY

THOMAS-MORSE AIRCRAFT CORPORATION

MAIN OFFICE AND PLANT, South Hill, Ithaca, New York
AUXILIARY PLANT, Brindley Street, Ithaca, New York

President	F. L. MORSE
Vice-President	WILLIAM T. THOMAS
Treasurer	JEROME A. FRIED
Secretary	RAYMOND WARE
Chief Engineer	B. DOUGLAS THOMAS

UPON the signing of the Armistice, the quantity manufacture of airplanes for war purposes was quickly brought to a standstill, except for the completion of some one hundred planes and a number of

Thomas Morse Fighter M.B.-3

The results of the sandload tests on one of the four machines ca- ried out at Dayton by the Engineering Division were none the le s remarkable. Where a factor of safety of eight was required in t wing structure, a factor of over ten was found. In the case of the control surfaces a sandload of over fifty per cent. greater than th called for in the contract was placed upon them without failure serious deflection. As the wing structure itself did not fail, a subs quent test was made upon the laminated wood wing beams, resulti in a factor of safety of over fifteen or almost twice that required. Although this type of construction was developed for war machines, its light weight-strength characteristics are well suited to machines for peace purposes.

An interesting speed comparison was made between the Thomas-Morse type S.-4-C single-seater advanced army training machine and the M. B.-3 pursuit type. With the 80 horse-power LeRhone engine in the S.-4-C machine all out, making a speed of approximately ninety-seven miles per hour, it was not able to hold the pursuit machine with its 300 horse-power Hispano engine, throttled to approximately 25 per cent. of its maximum power.

With a view to anticipating the demand for an all purpose tw-

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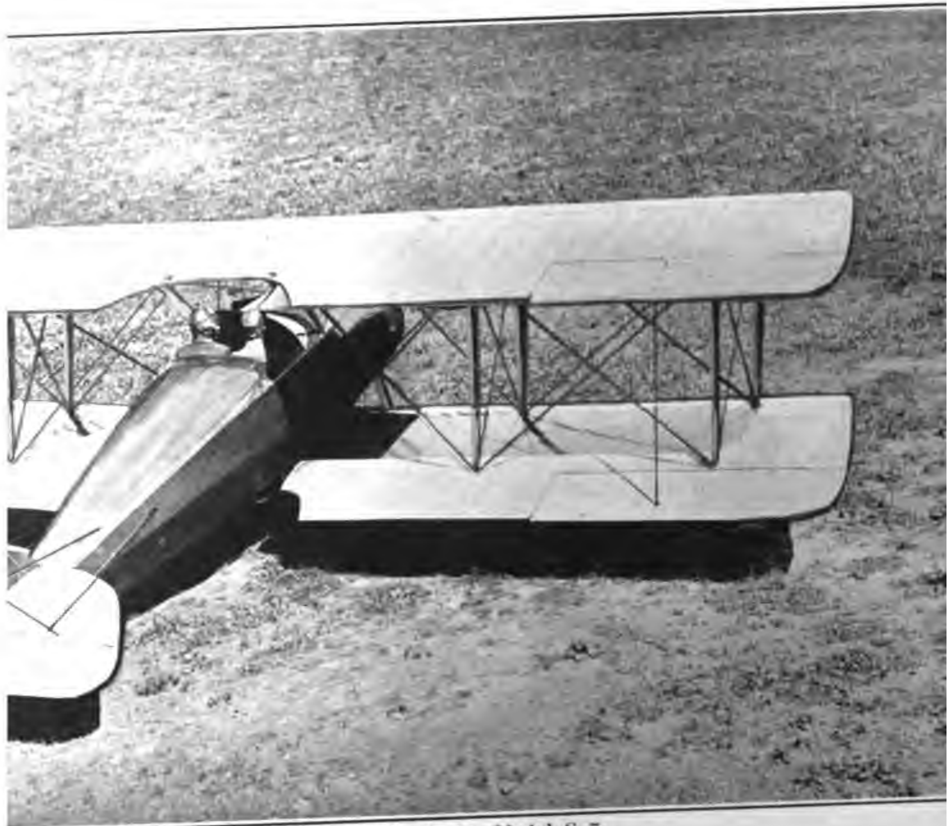


Thomas-Morse Sociable Seater Model S.-7

footbar to the pilot's controls. This method of interconnecting tl pilot and passenger controls has proved very satisfactory, permittii the pilot control at all times even against the will of the passenger student receiving instruction, without, however, actually disconnec-ing the secondary control.

In June, 1919, the United States Post Office Department requeste bids for the construction of ten mail machines to be equipped wi two or three Liberty or Hispano-Suiza engines, to carry from fifte hundred to three thousand pounds of mail. As a result of its bid, the Corporation was awarded an order for four machines, to be equipped with two 300 horse-power Hispano-Suiza engines to carry fifteen hundred pounds of mail. One of the requirements of the contract was that the machines must be capable of carrying the required mail load with one engine. To most satisfactorily carry out this requirement, the design provided for the two power plants in a center nacelle, placed back to back, one driving a tractor propeller and the other a pusher. This novel arrangement was most favorably received by the Post Office Aerial Mail committee, as pro-

pleted near the end of the year and was tested early in 1920.

Outline specifications of the Thomas-Morse machines brought out during the year 1919 follow:

THOMAS-MORSE AIRCRAFT CORPORATION

AIRPLANE SPECIFICATIONS

MODEL M.B.-3. PURSUIT MACHINE

Dimensions: Length, 19 ft. 11 in.; span, 26 ft.; height, 8 ft.

Areas and Weights: Wing area, 250.5 sq. ft.; gross weight, 2037 lbs.

Power Plant: One Hispano-Suiza, Model H, 300 horse-power; tractor propeller.

Performances: Speed, 60–163⅝ m. p. h.; climb, 10,000 ft. in 4 min. 52 sec.

MODEL S.-7. ADVANCE TRAINING MACHINE. SIDE-BY-SIDE SEATER

Dimensions: Length, 21 ft. 6 in.; span, 32 ft.; height, 9 ft.

Areas and Weights: Wing area, 360 sq. ft.; gross weight, 1480 pounds; useful load, 475 pounds.

Power Plant: One LeRhone 80 horse-power rotary; tractor propeller.

Performances: Speed, 38–95 m. p. h.; climb, 6500 ft. in 10 min.

MODEL S.-6. ADVANCE TRAINING MACHINE. TANDEM TWO-SEATER

Dimensions: Length, 20 ft. 8 in.; span, 29 ft.; height, 8 ft.

Areas and Weights: Wing area, 269 sq. ft.; gross weight, 1396 pounds; useful load, 472 pounds.

Power Plant: One LeRhone, 80 horse-power rotary; tractor propeller.

Performancess Speed, 40–105 m. p. h.; climb 8000 ft. in 10 min.

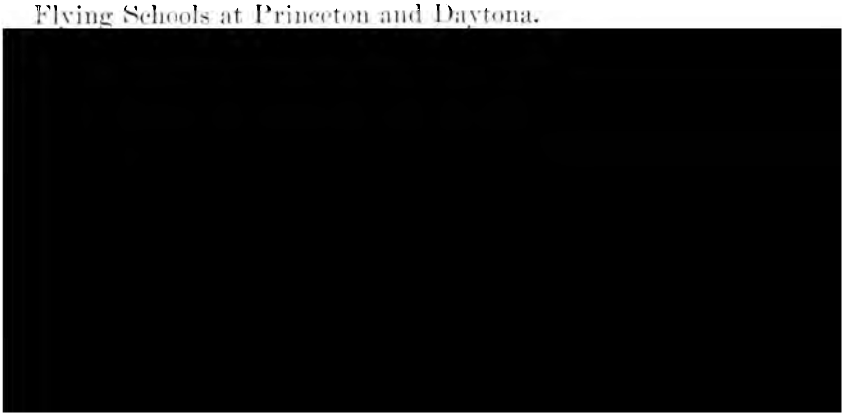
of production would be reduced to a minimum, which would be consistent with durability and efficiency, to carry not less than three passengers. The manufacture has been reduced to simply rebuilding machines for individuals.

Our engineering department reports that their plans for the three passenger machine are about completed, and we contemplate building three or four of these craft at an early date, although we have not indicated to the public that we would build any of these machines at the present for the market.

Our engineering department has been held intact, although the mill and the assembling department have been temporarily diverted to other lines, but at any time when the airplane business justifies it and shows some signs of stability, our entire plant could be brought back to its full capacity.

For quite a few months after the Armistice was signed, we continued to the completion of our contract with the Government, but since the completion of this contract, we have not built any new complete machines.

When the Armistice was signed, we again placed in operation our Flying Schools at Princeton and Daytona.



Ordnance Scout, Hispano-Suiza powered

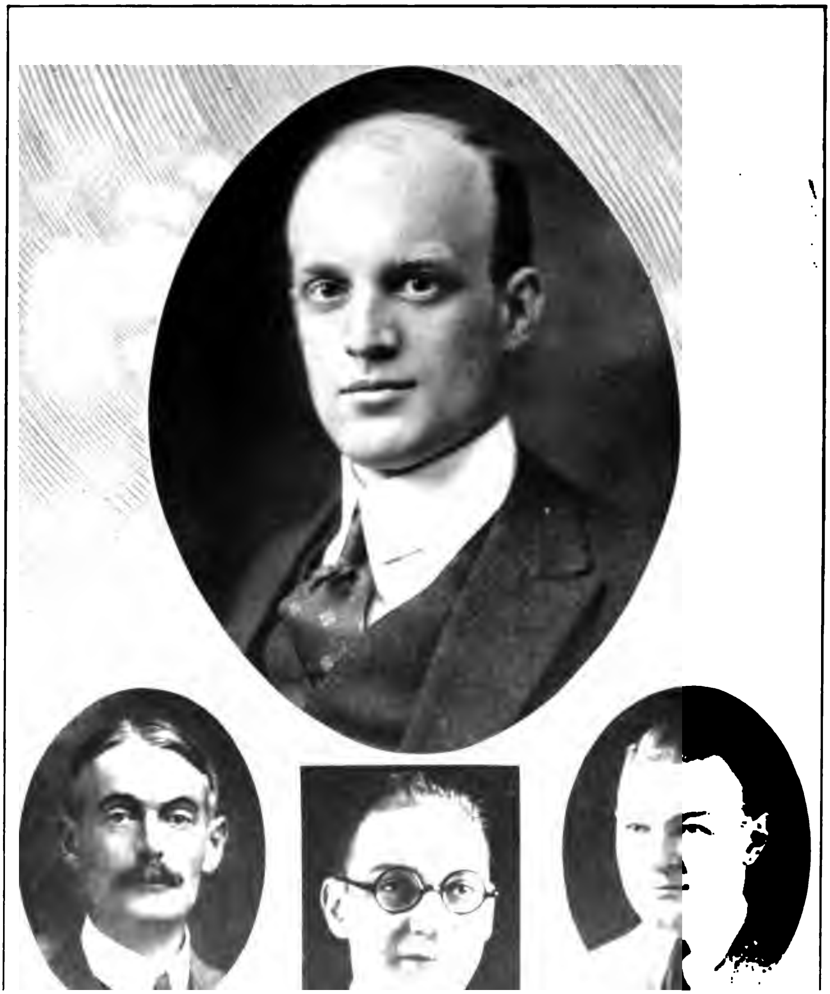
In order that the corporation may be in the best possible positi to continue the production of improved Wright Hispano engines a to work out new problems under proper conditions the New Brun wick plant has been sold to the International Motor Truck Compan This sale has enabled the corporation to purchase a new site Frelinghuysen Avenue in Newark, upon which a new factor especially designed for the needs of aviation engine work, is bei constructed. Special attention is being paid in the initial constru tion to immediate requirements but all plans are being laid out with a view to expansion, so that the factory will be able to increase its production with the greatest possible rapidity and with practically no interference with operations at any time.

Manufacturing on a small scale will be carried on in the Experimental Department at New Brunswick until the new factory is completed.

After the signing of the Armistice a period of approximately six months was taken for the completion of the corporation's government contracts. Since that time a small amount of experimental work has been carried on for both the Army and Navy Departments and at the present time the 180 horse-power Model "E" engine is being

Loening Monoplane, Hispano-Suiza powered

ispano-Suiza powered



The illustrations accompanying this article show three typical e amples of plane installations using the Hispano-Suiza motor. The are a number of others, such as the Thomas-Morse Scout illustrat elsewhere, but the three shown will serve as reasonable examples developments around the "Wright Hispano."

The Loening two seater fighter was designed especially to me the call of the Army toward the end of the war for a very high spe two seater machine of great maneuverability. This machine has n... only shown its ability as a land ship but is being built for the Navy as a pontoon type seaplane. It is equipped with a 300 horse-power Type "H" Wright Hispano motor.

The Ordnance Scout was built in response to the request of the War Department for an ultra high speed single seater machine. The performance has been exceptionally high. As it was developed for the Air Service, the exact figures are not available. It is equipped with a 300 horse-power Type "H" Wright Hispano.

The V.E.-7, or Vought Bluebird, was especially developed as an advanced training machine for the Air Service. It has shown very marked ability for a machine designed for a 150 horse-power motor and is widely used to-day in the Air Service. It is equipped eith

CHAPTER IX

CHRONOLOGY OF AERONAUTICS

Nov. 15, 1918 – Jan. 4, 1920

(For Earlier Chronology, see "Aircraft Year Book, 1919")

* See amplification at close of this chapter.

1918

November 15 — Handley-Page at Cricklewood Field, England, carries 40 people 30 minutes at altitude of 6,500 feet.

Dec. 13–Jan. 16 — *England to India.* Four motored Handley-Page piloted by Major MacLaren and General McEwen of the Royal Air Force arrives in Calcutta, a distance of approximately 6,500 miles from England.

December 24 — United States Naval non-rigid dirigible A-236 flies from Key West to Tampa, Cape Sable, Palm Beach and return, covering approximately 691 miles and maintaining continuous flight for 40 hours and 48 minutes.

December 31 — Lieutenant-Commander P. N. L. Bellinger carries 5 passengers and 542 pounds additional weight 668 miles in 9 hours and 1 minute continuous flying.

1919

January 2 — *New altitude record* established by Captain Lang, R. A. F., at Ipswich, England, with passenger. Altitude of 30,500 feet reached unofficially.

January 6 — *Transcontinental Pathfinding Tour.* Four army Curtiss J.N.-4-H (Hispano-Suiza) airplanes complete 4,000 mile flight in 50 flying hours. Aerial photographs and maps taken and aerial mail routes and landing fields selected.

January 12 — *Rockaway to Key West.* United States Naval dirigible C1 (Goodyear) flies 1,450 miles.

January 24 — *New Italian Record.* Italian biplane, the Marchetti Vickers Terni, equipped with 200 horse-power Spa motor, and piloted by Sergeant Elia Lint, attains, under official tests, and over a closed circuit, an average speed of 160 miles per hour.

January — Navy airplane successfully launched from dirigible in flight.

January 26 — *Marseilles to Algeria.* Lieutenant Roget and Captain Coli pilot French Breguet airplane across Mediterranean Sea, a distance of 457 miles in five hours.

February 1 — *Endurance flight.* Cape May, New Jersey. Goodyear Airship flies 33 hours. Assuming average speed to have been 40 miles per hour, approximately 1320 miles were flown.

February 2 — *Annual Flying Circus* held at Rockwell Field, San Diego,

February 21	*American Speed Record.* Thomas-Morse Scout, equipped with 300 horse-power Hispano-Suiza motor, attains speed of 164 miles an hour at Ithaca, N. Y., recorded as witnessed and officially recognized by Director of Military Aeronautics.
March 1–15	First Annual Aeronautical Exposition of Manufacturers Aircraft Association at Madison Square Garden and 69th Regiment Armory, New York City.
March 1	*French Aerial Mail Service* established between Paris, Bordeaux and Marseilles.
March 2	*Italian Aerial Mail Service* established between Padua, Italy, and Vienna, Austria, a distance of 304 miles.
March 3	*Canada–United States Air Mail.* W. E. Boeing, in a Boeing seaplane, flies from Vancouver, British Columbia, to Seattle, a distance of 200 miles. The trip was authorized by the Canadian Post Office and the bag was officially received in Seattle by the Mayor of that city.
March 6	Pilot C. J. Zimmerman in an Aeromarine Model 40 Flying Boat, meets S.S. *Leviathan* carrying the 27th Division at sea, and drops a bag of letters of welcome on board addressed to Major-General John J. O'Ryan.
March 12	Commercial delivery by airplane made in Curtiss J.N. by Roland Rohlfs for New York department store,—Mineola, Long Island, to Mt. Vernon.
March 13	Curtiss M.F. boat sent by Commander Schofield as aerial ambulance from Far Rockaway, Long Island, to St. Luke's Hospital, New York City.
March 20	*150 mile radio telephone conversation.* Secretary of Navy Daniels talks to pilot in seaplane in flight.
March 22	*3 D.H.-4 airplanes cross Sierra Nevada* mountains at altitude of 14,000 feet, flying from Mather Field, Sacramento, to Carson City, Nevada, in 85 minutes, as compared with average train time of 9½ hours.
March 23	*Marseilles to Paris.* M. Roget covers approximate distance of 500 miles in 3 hours and 45 minutes.
April 4	Lieutenant Cortinez, of Chilean Army, crosses Andes Mountains at altitude of 19,800 feet in British Bristol monoplane.
April 6	*Lyon, France–Rome, Italy.* M. Goget makes non-stop flight from Lyon to Rome, distance of 684 miles in 7 hours.
April 16	*Flight across Continent.* Major T. C. Macauley piloting D.H.-4 airplane, arrives at Souther Field, Americus, Georgia, from San Diego, California, distance of 2,400 miles, in 19 hours flying time, completing round trip flight in 44 hours

[redacted]

gressional consideration of suitable plans for developing aerial navigation. The establishment of the necessary aids to such navgation, the investigation of development of the fundamental principles of commercial aeronautics, the promotion of airship service to distant countries, are matters which demand the prompt establishment of a separate department of the government. One of its chief duties should be to provide the necessary information which will make possible the use of aerial navigation as an aid to foreign trade."

April 26	Final speed tests on Curtiss *Wasp* at Garden City show 160.1 to 162 miles per hour with full military load.
April 26	*World Duration Record.* United States Naval F-5-L flying boat remains in air 20 hours and 19 minutes with crew of four; 1,250 nautical miles covered.
May 2–10	Southeastern Aeronautical Congress meets at Macon, Georgia.
May 3	*First Passenger Air Service in United States.* Mrs. J. A. Hoagland and Miss Ethel Hodges are carried from New York to Atlantic City and return by pilot Robert Hewitt in an Aeromarine Model 50 "S" Flying Boat.
May 5	French machine climbs to altitude of 4,860 meters with 24 passengers.
*May 8	Departure of N.C. 1-3-4 from Rockaway on first leg of Trans-Atlantic flight.
May 8	Martin Bomber flies 650 miles in 7 hours and 55 minutes completing round trip flight from Macon, Georgia, to Washington.
May 8	United States Naval Macchi flying boat establishes altitude record of 10,800 feet in 15 minutes at Hampton Roads, Virginia, with one passenger.
May 10	German machine flies from Berlin to Stockholm, 570 miles, in 7 hours.
May 10	French machine flies 690 miles from Paris to Copenhagen in 8 hours.
May 11	Navy's free balloon race won by Lieutenant P. D. Collins. Winner remains aloft 21 hours 9 minutes and covers 420 miles.
May 14	Navy's C-5 dirigible (Goodyear) makes record flight of 1,115 miles from Montauk Point, Long Island, to St. Johns, Newfoundland, in 25 hours and 40 minutes on first leg of Trans-Atlantic flight. Severe storms after landing tears dirigible from its moorings and carries it out to sea, where it is lost.
May 15	*Boston to Atlantic City.* M. W. Hodgden in a Whittemore-Hamm L-2 biplane with a 90 horse-power engine flies from Boston to Atlantic City in 3 hours and 59 minutes.
May 15	Aerial Mail Service established between Chicago and Cleveland.

May 24	Lieutenant Roget of French Army flies 1,375 miles in nc stop flight from Paris to Morocco.
*May 27	*First Trans-Atlantic flight.* United States Navy's N.C (Navy-Curtiss) successfully completes Trans-Atlantic fligh landing at Lisbon, Portugal.
*May 31	N.C.-4 arrives at Plymouth, England, completing last leg first Trans-Atlantic flight.
June 1	*Establishment of aerial forest patrol.*
June 1	Baroness de la Roche ascends 12,870 feet in single motor G3 Caudron, breaking world's altitude record for women.
June 3	Regular merchandise delivery begun at Chicago with Curt J.N.'s by cloak manufacturers.
June 13	Lieutenant Casale, of French Army, reported to have reached altitude of 33,100 feet in type 29 Nieuport airplane. This reading of the barograph is without air temperature and other corrections.
*June 14	***First non-stop Trans-Atlantiq flight.* Captain John Alcock, pilot, and Lieutenant Arthur Whitten Brown, navigator, complete first non-stop flight across Atlantic Ocean in 15 hours and 57 minutes.**
June 17–20	R-34, largest of British dirigibles, cruises for 56 hours.
July 2	N.C. heroes officially dined by the American Flying Club in New York City.
*July 6	*First Trans-Atlantic dirigible flight.* R-34 lands at Roosevelt Field after having successfully completed the first leg of its round-trip Trans-Atlantic flight.
July 7	*Non-stop speed record.* Captain L. H. Smith in a DeHaviland Bluebird flies from San Francisco to San Diego, 610 miles in 246½ minutes.
*July 9	R-34 starts on return trip to England.

	lator, ascends 16,500 feet in a seaplane with one passenger.
*July 24–Nov. 9	"*Round the rim*" *flight*. Lieutenant-Colonel R. L. Hartz and Lieutenant E. E. Harman in a Martin Bomber start from Bolling Field, Washington, District of Columbia. Complete circuit of the United States is made covering 9,823 miles.
July 28	First test by United States Bureau of Fisheries of observation of fish schools from aircraft is made at Cape May, New Jersey, with the cooperation of Naval Air Station, showing possibilities of aircraft in research and commercial lines.
July 28	*Independent Air Service.* Representative Curry introduces bill to establish a Department of Aeronautics, which is referred to the Committee on Military Affairs.
July 30	*Flight over the Andes.* Lieutenant Locatelli, Italian, first to cross South American Continent by air — from Buenos Aires to Valparaiso, 800 miles.
July 30	*New American altitude record.* Officially made by Roland Rohlfs in Curtiss *Wasp* triplane when he ascends 30,300 feet.
July 31	*Flight over the Sierra Nevadas.* Lieutenants J. M. Fetter and Tobin S. Curtiss make a trip from Sacramento, California, to Ogden, Utah, 540 miles in Curtiss-Hispano machines.
July 31	*Independent Air Service.* Senator New introduces a bill to create a Department of Aeronautics, which is referred to Committee on Military affairs.
Aug. 1–Sept. 14	*International Aircraft Exposition, Amsterdam, Holland.* First exposition in Europe since Armistice. Among aircraft flown to the show was an 8 passenger Blackburn which flew from Leeds via London and Brussels — 440 miles. By night, planes flew to London for theater, returning in morning. 10,000 flights were made during show.
August 1	Lieutenant J. P. Corkville with Sergeant J. R. Cook in Lepere fly 186 miles from Arcadia, Florida, to Daytona Beach in 75 minutes, flying 148 miles an hour at 6,000 feet altitude.
August 2	*137 miles an hour at altitude of 18,400 feet.* Lepere machine piloted by Major R. W. Schroeder, and equipped with a 400 horse-power Liberty motor establishes a record at McCook Field, Dayton, Ohio.
August 2	*Glides 35 miles.* "Tex" Marshall in Thomas-Morse plane, makes record from altitude of 17,000 feet, when he glides 35 miles, renewing power at an altitude of 6,000 feet.
August [illegible]	Pikes Peak circled by Lieutenants A. Landrum and Ira J. Humphries.
[illegible]	*London to Madrid.* British service plane flies 900 miles in

August 8	*Speed record.* Colonel H. B. Claggett in a D.H.-4 flies fro Washington to the Statue of Liberty, 210 miles, in 1 hou 24 minutes.
August 11	*Paris to Morocco.* Farman Goliath carrying 10 passenger makes 1,116 miles in 16 hours, 20 minutes.
August 13	*One passenger record.* Lieutenant Weiss with mechanici Begul, both French, attains an altitude of 30,000 feet in minutes.
August 13	*All-American Pathfinders.* Thirteen army airplanes fly 4,0 miles through 15 states to collect landing field and mappi data and stimulate recruiting.
August 14	*First mail delivered by flying boat to steamer at sea.* Aeromarine flying boat drops bag on forward deck of White Star liner *Adriatic* 1½ hours after she leaves her pier in New York.
August 18	Lieutenant De Rissis flies from Buenos Aires to Asuncion and return, 1,300 miles, in Bristol airplane.
August 18	*England to Denmark.* Major F. Gron with 7 passengers in Handley-Page machine, flies from London to Copenhagen, 640 miles.
August 22	*Buffalo to New York.* Curtiss 3 passenger Oriole biplane, piloted by J.D. Hill, flies 440 miles in 4 hours, 10 minutes.
August 22	*Aerial Mail Day in Cleveland.* Members of Manufacturers Aircraft Association, Officials of Army Air Service, and Aerial Mail participate in ceremony under auspices of Cleveland Aero Club and Cleveland Chamber of Commerce.
August 24	*Airship over Berlin.* With 35 passengers the "Bodensee," 394 feet long, circled Berlin at a speed of 75 miles an hour.
*August 25-29	*New York-Toronto Aerial Derby.* Conducted by American Flying Club.

ing a course of approximately 270 miles in 135 minutes at the rate of 2 miles a minute.

September 5 — *Berlin to Switzerland.* Regular passenger air service is opened between resorts of these countries.

September 5 — *Whale-hunting with airplanes.* Machines patrol west coast of Vancouver Island, and when whales are spotted the news is wirelessed to whaling ships.

September 5 — *Air service for Belgian Congo.* An aeronautic mission is now in the Belgian Congo, organizing a passenger carrying air service. Twelve seaplanes will be used between Kinchasna and Stanleyville, 1,050 miles.

September 6 — *New altitude record* officially made by Major R. W. Schroeder and Lieutenant G. Elfrey who ascend 29,000 feet in a Lepere airplane, at Dayton, Ohio.

September 8 — *Italy to Holland.* Lieutenant Campacii and petty officer Guarnieri of the Royal Italian Navy cross Alpine mountain chain in Switzerland with a Savoia seaplane, then follow Rhine to Amsterdam.

September 13 — Lawson air liner arrives in New York from Milwaukee.

September 14 — *Altitude record.* Roland Rohlfs makes a new record of 34,200 feet flying Curtiss Triplane. Unofficial.

September 14 — *Cairo to Paris.* Commander Vuillemin, French, makes a trip of 2,500 miles, stopping at Constantinople and Istris near Marseilles, using a French service plane.

September 15 — *Holland to England.* Vickers-Vimy commercial machine with 8 passengers makes trip from Amsterdam to Hounslow in 2 hours, 50 minutes.

September 16 — *Radio test.* Airplane 2,000 feet up sends radio to submerged submarine. Test is made at Fishers Island.

September 17 — *Austria to France.* Lieutenants Story and Blizence of the Czecho-Slovak aviation service make flight from Prague to Paris via Mayence, approximately 600 miles.

September 17 — Twelve passenger Glenn L. Martin army transport flies to Dayton, Ohio, from Cleveland at 117 miles an hour.

*September 18 — *Official World's Altitude Record.* Roland Rohlfs climbs 34,910 feet in a Curtiss *Wasp* triplane, equipped with a Curtiss K-12 400 horse power motor. For purposes of international comparison the barograph was read without air temperature corrections, thus conforming with European practise. After calibration by the Bureau of Standards, Rohlfs' barograph showed a minimum corrected altitude of 32,450 feet. These readings give Rohlfs the oficial record in both corrected and uncorrected classes, his nearest rival being Lieutenant Casale, who is reported to have reached an uncorrected altitude of

	climbing to 18,759 feet, developing at the same time a spe of 131 miles per hour which is said to be considerably fast than any other American Seaplane.
October 1	Goodyear airship wins 1,021 mile National Free Ballo Race, St. Louis, Missouri.
October 4	*Two man Altitude Flight.* Major R. W. Schroeder, Pilot, a Lieutenant George W. Elsey, Observer, reach indicated a uncorrected altitude of 33,335 feet, in Lepere biplane, equipp with 400 horse-power Liberty motor. The engine was fitt with a supercharger and the plane was otherwise specia prepared. Barographs to the date of this writing had r been corrected by the Bureau of Standards. McCook Fie Dayton, Ohio, where the flight was made, reports corrections bringing the record down to 31,796 feet.
October 7	*Boy flies 2,000 miles with mother.* A Curtiss Oriole 3 passenger biplane, piloted by Ralph Block arrives at Mineola, Long Island, from Houston, Texas, with Mrs. Seymour E. J. Cox and her nine year old son, Seymour, as passengers, establishing a new record for a cross country airplane flight by civilians.
October 8–30	*New York to San Francisco airplane reliability test.* Race under auspices of American Flying Club.
October 14	*Air mail in Colombia (South America).* Experimental aerial mail service starts between Barranquilla and Puerto, Colombia.
October 14	*France to Australia flight.* Begun by Lieutenant Poulet, French pilot in French biplane.
*Oct. 14–Dec. 10	*London to Australia, 11,500 miles.* Four machines enter. Trip carries pilots over three continents and many seas

[redacted]

October 27	*Key West to Cuba Air Service.* Three Aeromarine flying boats, models 50 "S," 40 "C," 40 "L" fly from Key West to Cuba, inaugurating the service between these points.
October 28	*New looping record.* Alfred Flamval, French, in military airplane, loops 624 times in 2 hours at Villacoublay, France.
October 28	R-38, England's largest airship, is purchased by United States Navy for $2,500,000.
October 28	New York to Cuba air freight service is begun.
October 29	Glenn L. Martin mail plane, the first twin motored mail ship, begins service.
October 30 November 1	*Reversible propeller.* New American device tested at McCook Field, Dayton, Ohio, permits airplane to land and be brought to a stop within 50 feet.
November 1	Two Aeromarine boats leave New York for Miami, covering 1,350 miles in 19½ hours flying time.
November 6	Aerial flower service from Paris to Copenhagen. French plane covers trip with one intermediate landing in Holland, in one day, carrying half a ton of flowers.
November 9	*Morocco to Tunis.* Major Chentin and Lieutenant Pontanchan flies 1,250 miles without a stop.
November 17	Navy reports total hours of flight in heavier than air machines on other than patrol duty, for the year 1919, up to November 17th, 1919, to total 57,452. There were 3,399 hours spent in lighter-than-air flights — approximately 1,000 hours were spent in patrol flights of all kinds.
December 2	*Aerial mail speed record.* An L. W. F. remodelled D.H. mail airplane, equipped with two Hall-Scott motors, establishes new speed record from Washington, District of Columbia, to Belmont Park. Time, 1 hour, 34 minutes. Distance flown, 218 miles; speed, 138 miles an hour. 30,000 letters weighing 630 pounds carried.
December 3	*Havana to New York.* Pilot Zimmerman, in Aeromarine flying boat, makes return flight from Havana.
December 3	*Airplane Coast Patrol starts from Mineola, L. I.* Two D.H. machines leave Mitchel Field on flight to Langley Field, Virginia, establishing first coast patrol. The pilots will report ships between New York and Virginia and in the case of accident will wireless the position of the disabled vessels.
December 5	Senate Military Affairs Committee by a vote of 9 to 2, approves the Senate bill recommending a Department of Aeronautics, headed by a member of the President's cabinet.
December 5	*Endurance flight.* Goodyear airship flies 41 hours, 50 minutes at Key West, Florida. Assuming average speed to have been 30 miles per hour, the ship probably flew 1,255 miles.
December 16	*Three and three quarter miles a minute reported.* Sadi Lecointe, French Aviator, said to have attained speed of approx-

NC-4 TRANS-ATLANTIC FLIGHT

(May 16th–31st)

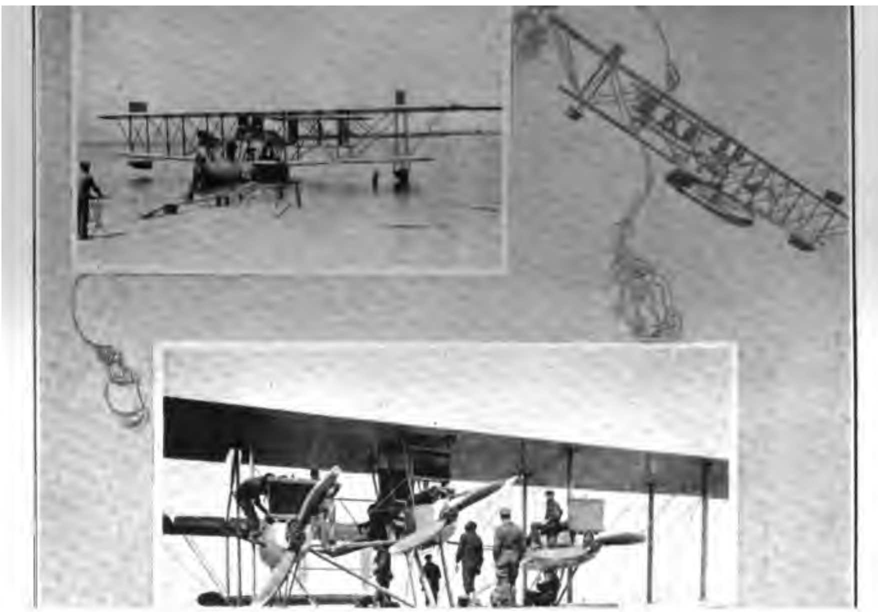
AT the close of the war the United States Navy laid its plans for an attempt to fly to Europe, to be made early in 1919. Route, seaplanes, commanders, fuel and auxiliary service were carefully discussed in Washington. The extensive organization which characterized the N.C. Flight, (the letters N.C. stand for Navy-Curtiss) the development of the Navy-Curtiss flying boats, and the selection of the Newfoundland-Azores-Lisbon-Plymouth route resulted from these Washington conferences. The Chief features of the organization were government weather reports, the extensive use of radio equipment, the assigning of government destroyers to act as tenders, and the establishing of a line of destroyers reaching from Trepassey,

again. Night came and the boat was buffeted by wind and rain. One of the elevators, badly damaged, had to be cut loose. The crew took turns steering, those off duty attempting to sleep. With morning, in the 22 hours of surface riding, the left wing tip was washed away. One of the crew crawled out on the right wing and clung there, deluged repeatedly by waves, to keep the left wing from being submerged. The wireless apparatus could receive but not send, and Commander Towers learned that the searching ships were looking for him west instead of south of Flores. Rescue seemed improbable, and the crew with rusty radiator water to drink, and scant supplies of chocolate and salty sandwiches, faced the task of bringing the damaged hull for hundreds of miles over seas running as high as thirty feet. For the next twenty-five hours, coasting backward over the great waves, beaten by rain, sleepless and hungry and worn, the five endured more than ever they can tell. Finally under their own power they taxied over the breakwater and into the harbor of Ponta Delgada. So ended a 52 hour, 205 mile journey over the open sea. The gloriously battered N.C.-3, though making port, was unable to continue the voyage to Portugal. The N.C.-4, arriving at Ponta Delgada from Horta on May 20th, went on alone.

The story of how Lieutenant-Commander Read completed the first flight across the Atlantic Ocean in an American-built flying boat with American-built engines, is best told in his official report to Commander John H. Towers, the commanding officer of the N.C. seaplanes, Division 1.

Picking up Lieutenant-Commander Read's story at Trepassey Bay:

Landing was made at Trepassey at 9.39 (May 15th) and once again the N.C. Seaplane Division I was a complete unit. The principal work done here was the removal of the center forward (low compression) engine and replacing with a



In daylight the smoke was always picked up first, except once in a while, during semi-darkness or thick weather, the searchlights would be seen first. Several destroyers were considerably out of position, estimated not more than 12 miles; some appeared exactly on.

Ran through light lumps of fog from 8 to 8: 15 A. M. 17th, and again at 9: 25. Soon afterward ran into thick fog at 1,200 feet. Nearly lost control, but straightened out and got above the fog into sunlight at 9: 58, 1,400 feet. Ran between fog layer and cloud layer, gradually climbing to keep above fog, occasionally changing course or reducing altitude again to avoid thick weather. Saw occasional glimpses of water. Appeared thick to port, with a strip of clear sky to starboard, gradually edging to south avoiding clouds. Occasional light rain. Radio compass indicated not much divergence from course. Destroyers 20 and 21 reported thick fog near water. No. 22 reported visibility 10 miles; air above fog very smooth. Altitude averaged 3,000 feet.

At 11: 27 sighted southern end of Flores through rift in fog. Altitude then 3,400 feet. Spiraled down and found fog 200 feet above water. Apparently a strong northwest wind had set in during latter part of time above the fog. On the surface the wind was about west, and force of 20 to 25 knots.

Laid course and picked up destroyer 23, visibility 10-12 miles. Weather then thickened. Missed No. 24 and decided to make Horta if possible. Sighted northern end of Fayal, air cleared in lee of that island. Rounded Fayal and landed at 1: 15 in a bight mistaken for Horta in the thick weather. We took off again at 1: 20, rounded the next point and landed near the Columbia off Horta at 1: 23.

We were held at Horta by fog and later a gale until the 20th. Meanwhile the crew of N.C.-1 arrived having abandoned their wrecked plane which later sank. Word was also received on the 19th of the arrival at Ponta Delgada of the N.C.-3, partially wrecked, but taxi-ing in under their own power.

Start was made from Horta at 12: 39 P. M. 20th, wind about 260° later shifting to 300°, 25 knots. Sea rough. Visibility 20 miles or better. Air rough around Pico, later smoother but not very good. Destroyers were sighted as usual. Passed a rain squall to Starboard. Sighted San Miguel at 1: 54 and landed at Ponta Delgada at 2: 24.

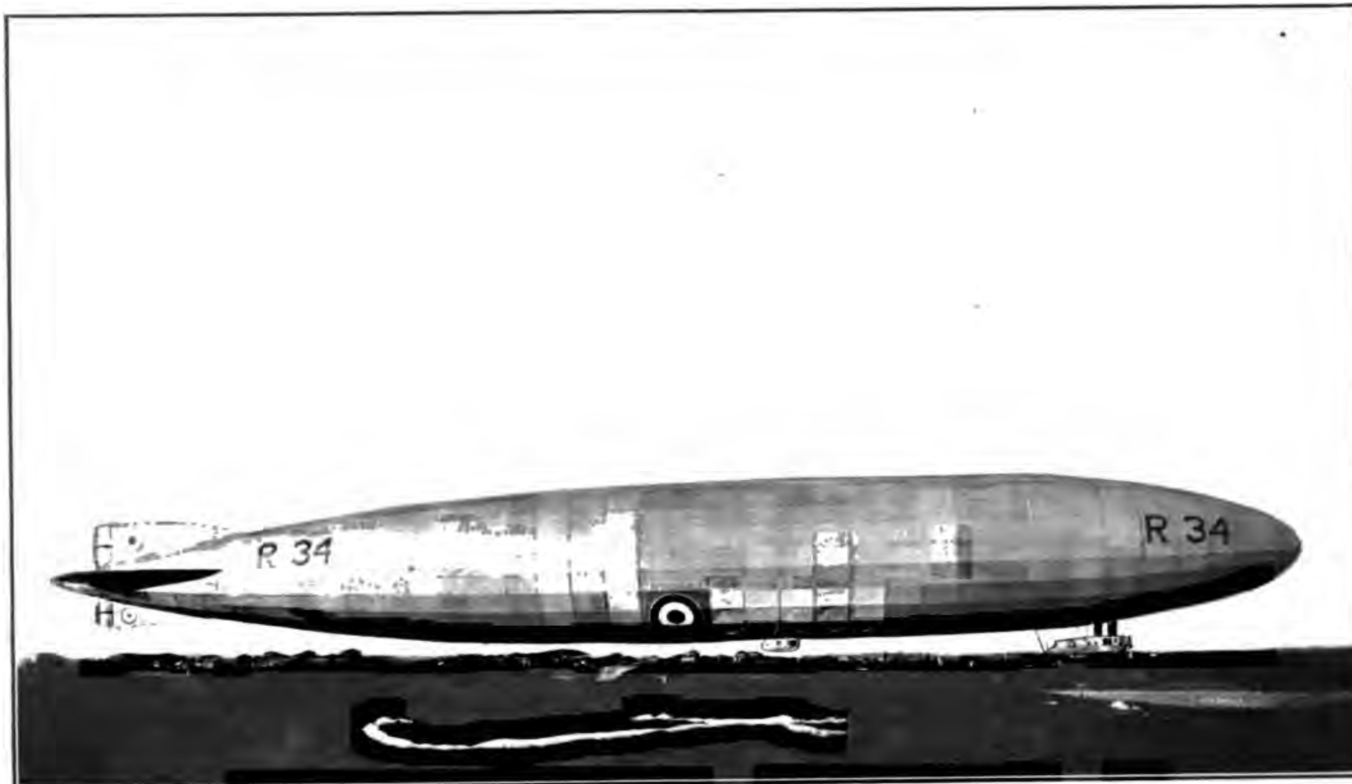
The next morning, 21st, an attempt was made to start on the run to Lisbon,

[redacted]

One rather hard porpoise was made in getting away. This caused one gimbal of the navigator's compass to jump out, causing an error of 7 to 8 degrees, although it was not noticed until sometime later. The first destroyer was picked up apparently in its proper place, but it must have been out of position to the southward. Number 2 was passed 10 or 12 miles to the north of us and only the smoke sighted. Number 3 was not seen at all. Headed on a more northerly course, and with the aid of the radio compass, picked up number 4 on the port bow. All the remaining destroyers were sighted.

Visibility varied from about 5 miles to 15 to 20 miles. At 1: 02 it was necessary to head 40° to the left of course to pass around a rain squall, but the next destroyer was later found without difficulty. At 2: 44 passed between two heavy rain squalls. At 7: 39 sighted Cape Roca, and passing over the lower Tagus, we landed at 8: 01 in Lisbon Harbor, and secured to a buoy.

Left Lisbon for Plymouth, England, at 5: 29 on May 30th. Circled over the city before starting out. Destroyers had been placed between Cape Roca and Cape Finisterre at 50-mile intervals, 10 miles off shore. Weather partly cloudy, visibility excellent, 8 knot wind from WSW. Encountered a light rain at 6: 30, but we dodged the worst of it. From 6: 45 to 6: 56 we were dodging other small squalls. At 7: 05 a leak of unknown origin was discovered in port engine. Headed toward land to find smooth water for landing in order to make repairs. At 7: 21 landed in the Mondego River above Figueire, Portugal. As the river was full of sand bars, found it necessary to wait until high tide in the afternoon for making getaway. The water pump of port engine was leaking, but [redacted]



R.-34 at Roosevelt Field, Long Island, New York. First to make round trip Atlantic Flight

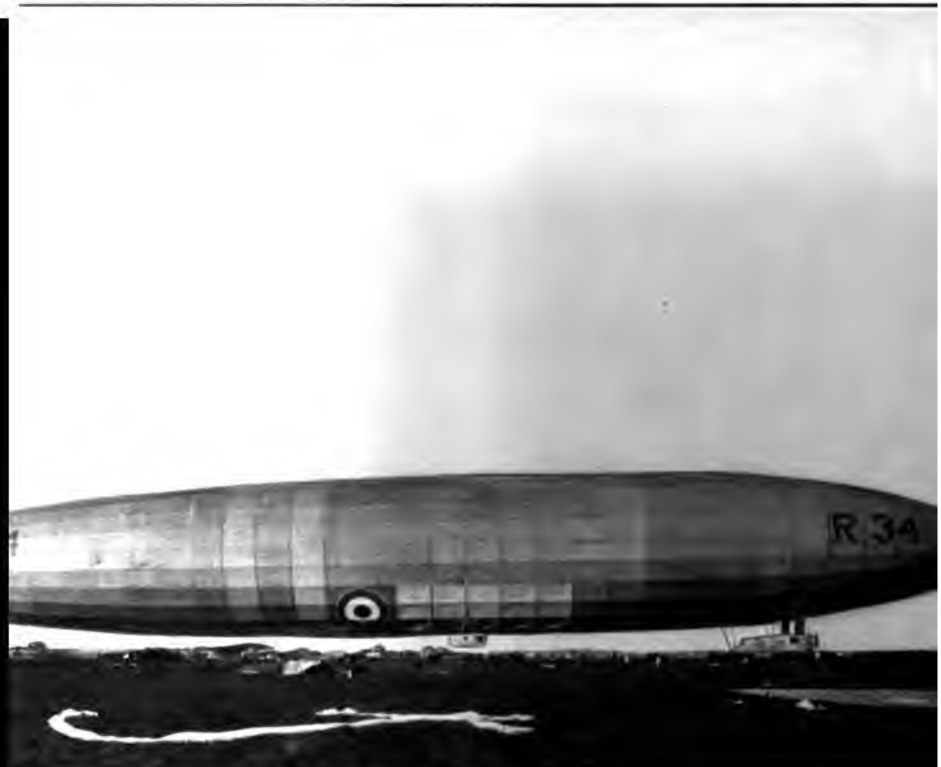
The 1,936 miles across the ocean were flown under bad weath conditions, the plane continually running into heavy fog which pr vented bearings being taken either from the sea or sky. Early in tl flight the tiny propeller which actuated the generator of the wirele sending apparatus blew off and the receiving instruments we jammed by signals intended for other stations. For four hours tl plane was wrapped in a sheet of ice caused by frozen sleet. Densi of the fog made it impossible to see the workings of the speed indicator. Captain Alcock lost all sense of the horizon; and the plane looped and stunted.

The winds were favorable all the way — northwest and at times southwest. The engines ran well with the exception that one exhaust pipe blew off and made the pilot very deaf.

The flight must be regarded as a splendid demonstration of Lieutenant Brown's ability as a navigator. The voyage ended exactly where Brown said it should.

The prize of $50,000 offered by the London *Daily Mail* was divided between Alcock and Brown.

Specifications of the Trans-Atlantic Vickers-Vimy Rolls are: [redacted]



[redacted]sevelt Field, Long Island, New York. First to make round trip Atlantic Flight

favorable for the crossing, but soon strong head winds were encountered and these the airship had to fight all the way to Newfoundland, which was sighted 59 hours after the start. During this portion of the passage the airship flew at altitudes varying from 400 to 7,000 feet. On shaping her course down the coast from Newfoundland, the R-34 ran into violent thunder storms, with winds at 50 miles per hour, which slowed down her progress considerably. The fuel supply was getting low and the commander considered the advisability of making Boston and sent out radio calls for assistance. Shortly afterwards, however, the wind veered and enabled the R-34 to reach Roosevelt Field unassisted. There, Squadron Leader Pritchard, Executive Officer of the R-34 jumped overboard by parachute from

:im" Bomber. Left to right: Lieut Col. R. S. Hartz, Sergt. John Harding, Jr., Lieut. E
mon, pilot; Sergt. Jerry Dubois.

tanks and a water tank, water ballast bags, parachute and hammock The crew space is near the forward car and here the whole width the keel is floored. Below the keel, accessible by ladders, are fo cars or gondolas. The forward car contains the control departme and the wireless cabin.

ROUND THE RIM FLIGHT

(July 24th to November 9th)

THE longest flight yet attempted in the United States was begu by the Air Service July 24th, and ended November 9th, 1919. Lieutenant-Colonel R. S. Hartz, commanding, with Lieutenant E. E. Harmon, assistant pilot, and M. S. E., S. J. Harding and J. Dobias, mechanic, started in a Glenn L. Martin Bomber from Bolling Field, Washington, District of Columbia, and made a complete circuit of the United States, a distance of 9,823 miles.

Colonel Hartz took a rim around the country route, which traversed thirty-one states and required him to cross the continent twice. He passed over or near 95 cities, 29 national forest reservations, 36 mountain ranges and mountains, portions of 48 oceans, gulfs, bays, [redacted]

The machine made 100 flights altogether in going the 9,823 miles. It required approximately 104 hours and 24 minutes to "circumaviate" the United States while his total flying time was 114 hours and 25 minutes.

During the trip the bomber's motors consumed 5,225 gallons of gasoline and 294 gallons of oil. The greatest altitude reached by the machine was 13,000 feet over the Coast Range of mountains.

On the first leg of the flight from Washington to Mineola, while flying over Baltimore it was found that the oil and water tanks were leaking. These were repaired by Master Electrician Tobias while the plane was moving 90 miles an hour, 5,000 feet over the city, from a position on the wires beneath one of the wings.

Specifications of the Martin Night Bomber are: Two Liberty Motors, 400 horse-power. Length 46 feet. Width 71 feet. Height 14 feet, biplane panels, four wheel landing gear. Weight, empty, 5,600 pounds; gasoline supply 285 gallons; crew, 4 men, bombs 1,500 pounds. Gross load 9,600 pounds. Speed landing 47 miles an hour, maximum 118.8 miles an hour, climbing 10,000 feet in 21 minutes.

New York Toronto Airplane Race and Handicap Contest

(August 25th–30th)

The New York–Toronto and return race, conducted by the American Flying Club was the biggest aeronautical sporting event in the history of aviation.

Fifteen civilian and thirty-seven army airplanes of many different types participated. Contestants were permitted to start from either New York or Toronto. Compulsory stops of thirty minutes were

[redacted]

Span (all planes) 31 feet 11 inches. Chord (all planes) 42 inches gap (between upper and middle planes) 42 inches gap (between middle and lower planes) 35$\frac{5}{16}$ inches. Wing areas, upper wings 112.0 square feet, middle wings 87.71 square feet, lower wings 87.71 square feet. Net weight machine empty 1,825 pounds, gross weight machine and load 2,901 pounds. Useful load 1,076 pounds. Fuel 400 pounds, oil 45 pounds. Performance: speed, maximum, horizontal flight 163 miles per hour, speed minimum horizontal flight 58 miles per hour. Climbing speed 15,000 feet in 10 minutes. Maximum range at economic speed 550 miles.

THE TRANSCONTINENTAL CONTEST

THE greatest aerial contest in history under the direction of the War Department and the American Flying Club was begun on the morning of October 8th, when sixty-four airplanes, of all types, started on the trip which required them to cross the continent twice, New York to San Francisco, a distance of 5,402 miles.

The planes left from the Atlantic and Pacific coasts simultaneously; forty-nine taking off at New York and fifteen at San Francisco. Lieutenant B. W. Maynard, winner of the Toronto–New York race, gained the lead during the early stages of the race, maintaining it to the end, thus winning the contest for elapsed time, in nine days, four hours, twenty-six minutes and five seconds. His nearest competitor, Captain J. O. Donaldson, finished the round trip in nine days, twenty-one hours, five minutes and twelve seconds. Captain L. H. Smith was third, having taken eleven days, two hours, fifty-one minutes and twelve seconds to make the 5,400 miles.

In the contest for actual flying time, Lieutenant Alexander Pearson was declared the winner, his time being forty-eight hours, fourteen minutes and eight seconds. Lieutenant L. H. Smith was second, it having taken him fifty-four hours, fourteen minutes and thirteen seconds to make the double crossing. Third place was won by Lieutenant L. S. Worthington, who made the round trip in fifty-four hours, twenty-one minutes and fifty-five seconds.

The order of finish allowing for handicaps was: Pearson, Maynard, Hartney, Smith, Worthington, Donaldson, Manzelman and Reynolds.

The purpose of the race was to demonstrate the despatch with which battle planes could be flown from coast to coast; to compile data which would assist in determining the reliability and general fitness

who, piloting a D.H.-4 with a four hundred horse-power Liberty Motor, made an average speed of one hundred thirty-three and eight-tenths miles an hour for the entire distance of ten hundred and forty miles. The handicap contest, in which the machines competed against their own theoretical still air performances, was won by Major Rudolph Shroeder, piloting a Vought V.E.-7, equipped with a one hundred and fifty horse-power Hispano-Suiza motor.

Roland Rohlfs, piloting a Curtiss *Oriole* with a 150 horse-power Kirkham motor, was the first civilian to finish and established the fastest time among the civilian entries. He also won first civilian place in the Handicap event.

Rohlfs Breaks World's Altitude Record

When Roland Rohlfs, chief test pilot for the Curtiss Aeroplane & Motor Corp., climbed 34,910 feet above sea level, starting from Roosevelt Field, Mineola, L. I., Sept. 18th, not only did he establish a new official world's record, but revealed the possibilities that are in the upper air for commercial and pleasure flying.

Rohlfs' flight breaks his July record of 30,400 feet and also far surpasses the altitude reported to have been reached by Lieut. Casale, of the French army. Casale's barograph showed 33,100 feet, without air temperature or other corrections. Under rules followed in Europe, it was not necessary for Casale to have such corrections made. For purposes of international comparison, therefore, a similar reading of Rohlfs' barograph is given. According to the report returned by the Bureau of Standards, after the instrument had been calibrated, this shows that he reached an official altitude of 34,-910 feet. After the air temperature corrections were made, a mini- [illegible] altitude of 32,150 feet was shown. Rohlfs thus holds the [illegible] both uncorrected (European) and corrected

Span (all planes) 31 feet 11 inches. Chord (all planes) 42 inch gap (between upper and middle planes) 42 inches gap (betwee middle and lower planes) $35\frac{9}{16}$ inches. Wing areas, upper win 112.0 square feet, middle wings 87.71 square feet, lower wings 87.7 square feet. Net weight machine empty 1,825 pounds, gross weig machine and load 2,901 pounds. Useful load 1,076 pounds. Fu 400 pounds, oil 45 pounds. Performance: speed, maximum, ho zontal flight 163 miles per hour, speed minimum horizontal flight 5 miles per hour. Climbing speed 15,000 feet in 10 minutes. Maxi- mum range at economic speed 550 miles.

THE TRANSCONTINENTAL CONTEST

THE greatest aerial contest in history under the direction of the War Department and the American Flying Club was begun on the morning of October 8th, when sixty-four airplanes, of all types, started on the trip which required them to cross the continent twice,

of the various types of airplanes used; to demonstrate that air mail service between the Atlantic and Pacific coasts is entirely practical; and to prove the commercial value of the airplane.

The total distance of the route from Mineola to San Francisco was 2,700 miles. Between these two points, stops were required at twenty controls, at the following points at which stops of at least twenty minutes and not more than forty-eight hours had to be made. The control stops were Binghamton, Rochester, and Buffalo, New York; Cleveland and Bryan, Ohio; Chicago and Rock Island, Illinois; Des Moines, Iowa; Omaha, St. Paul, North Platte and Sidney, Nebraska; Cheyenne, Wolcott and Green River, Wyoming; Salt Lake City and Salduro, Utah; Battle Mountain and Reno, Nevada; and Sacramento, California. The average distance between controls was 123 miles. The shortest jump was fifty-six miles between Rochester and Buffalo, the longest, 180 miles between Buffalo and Cleveland. The altitude of the land at the lowest control, San Francisco, was fifteen feet; at the highest, Wolcott, Wyoming, 6,623 feet. Time changed at Cleveland, North Platte and Salt Lake City.

The contestants covered a total of 124,777 miles, a great many times under adverse weather conditions. The race served to lay out the first transcontinental air route, with stops at not more than 180 miles apart. It also proved the necessity of weather reports and other meteorological information for pilots on cross country flights. Much valuable technical information was obtained, which would have been impossible to get in any other way.

A Hispano-Suiza engine was the only motor to make the complete

ber 23rd. Thence he continued east until he reached Rangoon, turning southward at that city, making a number of stops along the Malay Peninsula and in the Islands of Oceanica. He arrived at Bima, on Sunbawa Island, near Java, December 8th, and flew across the channel to Port Darwin, near the northern-most tip of Australia, December 10th

APPENDIX

I

U. S. AIRCRAFT MARKINGS

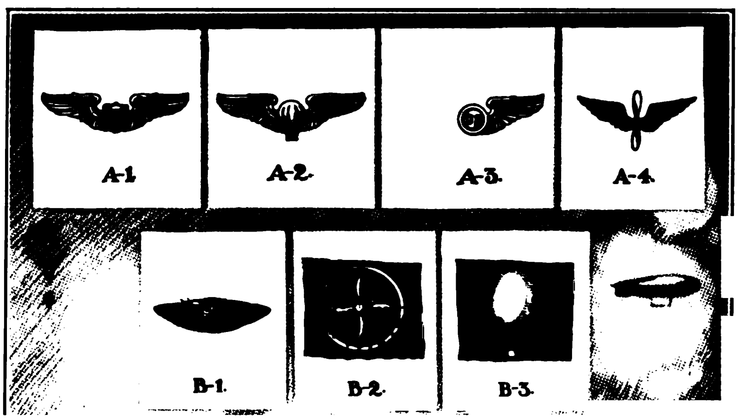
Since demobilization U. S. Army and Navy aircraft again display the "star insignia" of pre-war days.

It consists of a red circle inside of a white, five-pointed star, inside of a blue circumscribed circle. The circumference of the inner circle is tangent to the lines forming a pentagon made by connecting the inner points of the star. The inner circle is red, that portion of the star not covered by the inner circle is white, and that portion of the circumscribed circle not covered by either the inner circle or star is blue; the colors to be the same shades as those in the American Flag.

Insignia are placed on the upper and lower surfaces, respectively, of the upper and lower planes of each wing in such position that the circumference of the circumscribed circle shall be tangent to the outer tips of the planes. One point of each star is pointed directly forward and the diameter of the insignia is 60 inches.

In addition to the "star insignia" United States aircraft bear on the rudder three equally wide vertical bands — *red, white and blue.*

No provision exists in the form of a law for the marking of United States civilian aircraft. The nationality mark assigned to the United States by the International Air Navigation Convention is the letter "N." (See Chapter IV).


A-1.
A-2.
A-3.
A-4.
B-1.
B-2.
B-3.

a J.M.A., but in time of war any officer or enlisted man who especially distinguishes himself in active service may be so rated.

Balloon and Airship.

RESERVE MILITARY AERONAUT (R.M.A.), Under Act of June 3rd, 1916, after complying with certain tests and practical work, balloon and airship pilots can be rated as such. But none was ever so rated.

DIRIGIBLE PILOT. Rating established under Army Regulations, October 16th, 1919, for officers of, detailed in, or attached to the Air Service, who have demonstrated that they possess the required qualifications.

JUNIOR MILITARY AERONAUT (J.M.A.), Same as under Regulations of November 16th, 1917, above.

MILITARY AERONAUT (M.A.), Same as Military Aviator.

OBSERVERS

Airplane.

AERIAL OBSERVER is the rating given the graduate of a school of aerial observation.

Balloon and Airship.

Same as above.

Dirigible.

No provision for rating of dirigible observer.

GUNNERS

AERIAL GUNNER is the rating given the graduate of a school of aerial gunnery, either in airplane or airship.

BOMBERS

AERIAL BOMBER is the rating given a graduate of a school for aerial bombing, either in airplane or airship.

R.M.A.'s (Airplane Pilots and Dirigible Pilots), J.M.A.'s and M.A.'s receive 25, 50 and 75 per cent. increase in pay of grade respectively, when on flying status. Aerial Observers and Gunners receive 25 per cent. increase in pay when

IV

CORRESPONDING ARMY AND NAVY RANKS IN THE UNITED STATES, GREAT BRITAIN, FRANCE AND ITALY

United States Army	Great Britain Army	France Army	Italy Army
	Field Marshal	Maréchal-Général	
General	General	Maréchal de France	Generale
Lieutenant General	Lieutenant General	Général de Corps d'Armée	Tenente Generale
Major General	Major General	Géneral de Division	Maggior Generale
Brigadier General	Brigadier General **	Général de Brigade	Brigadier Generale
Colonel	Colonel	Colonel	Colonello
Lieutenant Colonel	Lieutenant Colonel	Lieutenant-Colonel	Tenento Colonello
Major	Major	Commandant	Maggiore
Captain	Captain	Capitaine	Capitano
First Lieutenant	First Lieutenant	Lieutenant	Tenente
Second Lieutenant	Second Lieutenant	Sous-Lieutenant	Sottotenente

United States Navy	Royal Air Force [1]	Great Britain Navy	France Navy
Admiral of the Fleet	Marshal of the Air	Admiral of the Fleet	
Admiral	Air Chief Marshal	Admiral	Amiralissime
Vice Admiral	Air Marshal	Vice Admiral	Amiral
Rear Admiral	Air Vice Marshal	Rear Admiral	Vice-Amiral
	Air Commodore	Commodore	Contre-Amiral
Captain	Group Captain	Captain — 3 years	
Commander	Wing Commander	Captain — under 3 years	Capitaine de Vaisseau
	Squadron Leader		
Lieutenant Commander	Flight Lieutenant	Lieutenant — 8 years	Capitaine de Frégate
Lieutenant	Flying Officer	Lieutenant — under 8 years	Capitaine de Corvette
	Pilot Officer		
Lieutenant Junior Grade		Sub-Lieutenant	Lieutenant de Vaisseau
Ensign			Enseigne de Vaisseau — 1 re classe
			Enseignede Vaisseau — 2 de classe
			Aspirant de Marine

** Temporary rank only.

1 No country outside of Great Britain has distinct rank titles for the aerial forces.

NOTE: We are unable to secure Italian Navy Ranks at present time.

amination covers the rigging, repair and maintenance of balloons. Methods of hydrogen production and aeronautical motors if the rating is sought in an organization operating airships.

Enlisted pilots, Aviation and Balloon Mechanicians on flying status, receive 50 per cent. increase in pay while on flying duty.

U. S. NAVAL AIR SERVICE

Following are the ratings of the flying personnel in the Naval Air Service:

NAVAL AVIATOR (N.A.)
NAVAL AVIATOR, Seaplane (N.A. (S.))
NAVAL AVIATOR, Dirigible (N.A. (D.))
KITE BALLOON PILOT (K.B.P.)

In the nomenclature used by the Navy "aviator" indicates the pilot of any power aircraft.

U. S. AERIAL MAIL SERVICE

Following are the ratings of the personnel (flying and non-flying) of the United States Aerial Mail Service:

PILOT (P.)
OFFICIAL (O.)
MECHANIC (M.)
CLERK (C.)

BRITISH ROYAL AIR FORCE

PILOT.................... (MAY BE OFFICER, CADET, OR SERGEANT.)
OBSERVER................. (MAY BE OFFICER, CADET, OR SERGEANT.)

FRENCH AIR SERVICE

V

ORGANIZATION OF UNITED STATES ARMY AIR SERVICE

Director of Air Service

MAJOR GENERAL CHAS. T. MENOHER

COLONEL O. WESTOVER................................*Executive*
LIEUTENANT-COLONEL S. W. FITZGERALD........*Assistant Executive*
MAJOR B. D. FOULOIS........................*Liquidation Division*
COLONEL WM. J. KENDRICK..........................*Claims Board*
AIR ATTACHES (Foreign)
COLONEL A. L. FULLER................*President, Advisory Board*
COLONEL W. F. PEARSON.................*Administrative Executive*
COLONEL E. A. TRUBY............................*Medical Division*
LIEUTENANT-COLONEL F. M. ANDREWS..........*Inspection Division*
LIEUTENANT-COLONEL R. B. LINCOLN...........*Personnel Division*
LIEUTENANT-COLONEL J. E. FICKEL..............*Finance Division*
CAPTAIN A. R. TRABOLD...................*Miscellaneous Division*

Information Group

LIEUTENANT-COLONEL H. M. HICKAM...............*Chief of Group*
CAPTAIN A. J. CLAYTON.................*Acting Assistant to Chief*
CAPTAIN J. I. MOORE.........................*Collection Division*
LIEUTENANT C. H. DOLAN, JR...................*Library Division*
LIEUTENANT T. J. ROWE....................*Reproduction Division*
MAJOR ERNEST JONES.....................*Dissemination Division*
CAPTAIN A. J. CLAYTON.........................*Special Division*

Commander L. H. Maxfield — Assistant Lighter-than-Air Division — Naval Aviator.

Commander W. G. Child — Liaison — Naval Aviator.

Lieutenant-Commander R. E. Byrd — Naval Aviator.

Lieutenant J. S. Fulton, Jr.—

Lieutenant (jg) L. B. Averill —

Operating Forces

Lieutenant-Commander H. C. Van Valzah — Naval Aviator.

Inspection and Survey

Test Board

Lieutenant-Commander V. C. Griffin — Naval Aviator.

Communications

COMMANDER H. T. DYER.
LIEUTENANT-COMMANDER S. M. KRAUS.
LIEUTENANT H. S. ALDEN.
LIEUTENANT C. F. GOOB.
LIEUTENANT H. W. ROUGHLEY — Naval Aviator.
LIEUTENANT (jg) J. C. JENNINGS.
LIEUTENANT (jg) E. B. KOGER — Naval Aviator.
LIEUTENANT (jg) J. C. LITTLE.
ENSIGN FRANK MILLER.
Bureau of Ordnance
COMMANDER A. C. STOTT.
LIEUTENANT (T) B. P. DONNELLY.
Bureau of Supplies and Accounts
COMMANDER H. D. LAMAR (P.C.).
Bureau of Yards and Docks
COMMANDER KIRBY SMITH (CEC).

VII

UNITED STATES AERIAL MAIL OFFICIALS

OTTO PRAEGER . . . . . . ***2nd Assistant Postmaster General***
J. B. CORRIDON . . . . ***General Superintendent***

Name	Rank	Last Formation	Airplanes	Balloons	Total
RICKENBACKER, EDW. V., Columbus, Ohio.	Captain	94	21	4	25
*LUKE, FRANK, Phoenix, Arizona.	2nd Lieut.	27	4	14	18
VAUGHN, GEORGE, A., Brooklyn, N. Y.	1st Lieut.	17	12	1	13
*KINDLEY, FIELD E., Gravette, Ark.	Captain	148	12	..	12
SPRINGS, ELLIOTT, W., Lancaster, So. Carolina.	Captain	148	12	..	12
LANDIS, REED G., Chicago, Ill.	Captain	25	9	1	10
*PUTNAM, DAVID E., Brookline, Mass.	1st Lieut.	139	10	..	10

Name	*Rank*	*Last Formation*	*Airplanes*	*Balloons*	*Total*
*RUMMEL, LESLIE J., Newark, N. J.	1st Lieut.	93	7	..	7
*SCHOEN, KARL J., Indianapolis, Ind.	1st Lieut.	139	7	..	7
SEWALL, SUMNER, Bath, Maine.	Captain	95	5	2	7
STOVALL, WILLIAM H., Stovall, Miss.	1st Lieut.	13	7	..	7
*BEANE, JAMES D., Concord, Mass.	1st Lieut.	22	6	..	6
CAMPBELL, DOUGLAS, Mount Hamilton, Cal.	Captain	94	6	..	6
CURTISS, EDWARD P., Rochester, N. Y.	Captain	95	6	..	6
GUTHRIE, MURRAY K., Mobile, Ala.	1st Lieut.	13	6	..	6
HAMMOND, LEONARD C., San Francisco, Cal.	Captain	91	6	..	6
HAYES, FRANK K., Chicago, Ill.	1st Lieut.	13	6	..	6

Name	Rank	Last Formation	Airplanes	Balloons	Total
HEALY, JAMES A., Jersey City, N. J.	Captain	147	5	..	5
KNOWLES, JAMES, Cambridge, Mass.	1st Lieut.	95	5	..	5
LUFF, FREDERICK E., Cleveland, Ohio.	1st Lieut.	25	3	2	5
O'NEILL, RALPH A., Nogales, Ariz.	1st Lieut.	147	5	..	5
OWENS, J. SIDNEY, Baltimore County, Md.	2nd Lieut.	139	5	..	5
RALSTON, ORVILLE A., Lincoln, Nebraska.	1st Lieut.	148	5	..	5
STRAHM, VICTOR H., Evanston, Ill.	Major	91	5	..	5

Edw., Jr., 1st Lieutenant; Burger, Valentine Jos., 2nd Lieutenant; Burns, James S. D., 2nd Lieutenant; Burtt, Buron T., Jr., 1st Lieutenant.

Campbell, Douglas, 1st Lieutenant; Carroll, George C., 1st Lieutenant; Cassady, Thomas G., 1st Lieutenant; Castleman, John R., 1st Lieutenant; Chambers, Reed M., Captain; Chapman, Chas. W., 2nd Lieutenant; Clapp, Kenneth Smith, 2nd Lieutenant; Clarke, Sheldon V., 1st Lieutenant; Coleman, Wallace, 1st Lieutenant; Conover, Harvey, 1st Lieutenant; Cook, Everett R., Captain; Cook, Harvey Wier, 1st Lieutenant; Coolidge, Hamilton, 1st Lieutenant; Cousins, John W., 1st Lieutenant; Curtis, Edward P., 1st Lieutenant; Cutter, Edward B., 1st Lieutenant.

Dawson, Leo H., 1st Lieutenant; DeCastro, Ralph E., 2nd Lieutenant; Diekema, William A., 1st Lieutenant; Dillon, Raymond P., 1st Lieutenant; Dodwell, Thomas B., 2nd Lieutenant; D'Olive, Charles R., 1st Lieutenant; Douglas, Kingman, 1st Lieutenant; Dowd, Meredith L., 2nd Lieutenant; Drew, Chas. W., Captain; Dickstein, Arthur William, 1st Lieutenant.

Easterbrook, Arthur E., 1st Lieutenant; Eaton, Warren Edwin, 1st Lieutenant; Elliott, Robert P., 1st Lieutenant; Erwin, William P., 1st Lieutenant; Este, J. Dickinson, 1st Lieutenant.

Ferrenbach, Leo. C., 1st Lieutenant; Fleeson, Howard T., 2nd Lieutenant; Follette, Justin P., 1st Lieutenant; Fontaine, Hugh L., 1st Lieutenant; Ford, Christopher W., Captain; Frank, William F., 1st Lieutenant; Frost, John, 1st Lieutenant; Furlow, George Willard, 1st Lieutenant.

Gaylord, Bradley J., 1st Lieutenant; George, Harold H., 1st Lieutenant; Giroux, Ernest A., 1st Lieutenant; Goettler, Harold Ernest, 2nd Lieutenant; Goldthwathe, George A., 1st Lieutenant; Grant, Alfred A., 1st Lieutenant; Graveline, Fred C., Sergeant, 1st Class; Grey, Charles G., Captain; Gundelach, Andre H., 1st Lieutenant; Guthrie, Murray K., 1st Lieutenant.

Hall, James Norman, Captain; Hamilton, Lloyd A., 1st Lieutenant; Hammond, Leonard C., 1st Lieutenant; Hart, Percival G., 2nd Lieutenant; Hartney, Harold E., Major; Harwood, Benjamin P., 1st Lieutenant; Haslett, Elmer R., Captain; Hays, Frank K., 2nd Lieutenant; Healy, James A., Captain; Henderson, Phil A., 1st Lieutenant; Hill, Maury, Captain; Hill, Raymond C., 1st Lieutenant; Higgs, James A., Jr., 1st Lieutenant; Hitchcock, Roger W., 2nd Lieutenant; Holden, Kenneth H., 1st Lieutenant; Holden, Lansing C., Jr., 1st Lieutenant; Holland, Spessard L., 1st Lieutenant; Hoover, William J., 1st Lieutenant; Hud-

Llewellyn, Frank A., 1st Lieutenant; Lowe, William O., 2nd Lieutenant; Lowry, Francis B., 2nd Lieutenant; Luke, Frank, Jr., 2nd Lieutenant.

MacArthur, John, 2nd Lieutenant; MacBrayne, Winfred C., 1st Lieutenant; McClendon, Joel H., 1st Lieutenant; McDermott, Cleveland W., 2nd Lieutenant; McDevitt, James A., 1st Lieutenant; McDougall, Harry O., 1st Lieutenant; McKay, Elmer K., 2nd Lieutenant; McKay, James R., 1st Lieutenant; McMurry, Ora R., 1st Lieutenant; Manning, James F., Jr., 1st Lieutenant; Maughan, Russell L., 1st Lieutenant; Meissner, James A., 1st Lieutenant; Michener, John H. 1st Lieutenant; Mitchell, William, Brigadier-General; Mitchell, John, Captain; Moore, Edw. Russell, 1st Lieutenant; Morris, Edw. M., 2nd Lieutenant; Morse, Guy E., 2nd Lieutenant; Myers, Oscar B., 1st Lieutenant.

Neel, Roland H., 2nd Lieutenant; Neibling, Harlow P., 1st Lieutenant; Nicholls, Harold O., Sergeant, 1st Class; Nixon, George R., 1st Lieutenant; Norris, Sigbert A. G., 2nd Lieutenant; Norton, Fred W., 1st Lieutenant; Noyes, Stephon H., 1st Lieutenant; Nutt, Alan, 1st Lieutenant.

O'Donnell, Paul J., 2nd Lieutenant; O'Neil, Ralph A., 2nd Lieutenant; Orr,

Oak Leaf Clusters Awarded with Distinguished Service Crosses

Arthur, Bogan H., 2nd Lieutenant.

Backus, David H., 1st Lieutenant; Baer, Paul Frank, 1st Lieutenant; Baucom, Bryne V., 2nd Lieutenant; Bernheimer, Louis B., 1st Lieutenant; Buckley, Harold R., 1st Lieutenant.

Campbell, Douglas, 1st Lieutenant; Cassady, Thomas G., 1st Lieutenant; Chambers, Reed M., Captain; Cook, Harvey Wier, 1st Lieutenant.

Dawson, Leo H., 1st Lieutenant.

Easterbrook, Arthur E., 1st Lieutenant; Erwin, William P., 1st Lieutenant.

Fleeson, Howard T., 2nd Lieutenant; Fontaine, Hugh L., 1st Lieutenant; Furlow, George Willard, 1st Lieutenant.

Guthrie, Murray K., 1st Lieutenant.

Holden, Lansing C., Jr., 1st Lieutenant; Hunter, Frank O'D., 1st Lieutenant.

Jones, Clinton, 2nd Lieutenant.

Kaye, Samuel, Jr., 1st Lieutenant; Kindley, Field E., 1st Lieutenant.

Larner, Gorman D'F., 1st Lieutenant; Luke, Frank, Jr., 2nd Lieutenant.

McMurry, Ora R., 1st Lieutenant; Meissner, James A., 1st Lieutenant.

O'Neil, Ralph A., 2nd Lieutenant.

Patterson, Alfred B., 1st Lieutenant; Peterson, David McK., Captain; Porter, Chas. Pullman, 2nd Lieutenant; Preston, Glen A., 2nd Lieutenant.

Reynolds, John N., Major; Reynolds, Clearton H., Captain; Rickenbacker, Edw. V., Captain.

Sewall, Sumner, 1st Lieutenant; Simon, Louis C., Jr., 1st Lieutenant.

Thaw, William, Major.

Wehner, Joseph F., 1st Lieutenant; White, Wilbur Wallace, 2nd Lieutenant; Wright, Chester E., 1st Lieutenant.

Distinguished Service Medal

Menoher, Chas. T., Major General; Patrick, Mason M., Major General; Mitchell, William, Brigadier General; Dunwoody, Halsey, Colonel; Milling, Thomas De W., Colonel; Chandler, Charles DeF., Colonel; Dodd, Townsend F., Colonel; Bolling, Raynal C., Colonel; Thomas, John R., Jr., Colonel; Whitehead, Henry C., Colonel; Lahm, Frank P., Colonel; Gorrell, Edgar S., Colonel; Fowler, Harold, Colonel; Sumner, Edwin Vose, Lieutenant-Colonel; Hall, Elbert J., Lieutenant-Colonel.

Howard C., 1st Lieutenant; Landis, Reed G., 1st Lieutenant; Luff, F. E., 1st Lieutenant; Springs, Elliott W., 1st Lieutenant; Tipton, W. D., 1st Lieutenant; Vaughn, George A., 1st Lieutenant.

French Decorations

Commander of the Legion of Honor

Menoher, Chas. T., Major General; Patrick, Mason M., Major General; Mitchell, William, Brigadier General.

Officer of the Legion of Honor

Dunwoody, Halsey, Colonel; Thaw, William, Lieutenant-Colonel.

Knight of the Legion of Honor

Gorrell, Edgar S., Colonel; Butterfield, A. D., Lieutenant-Colonel; Hartney, Harold E., Lieutenant-Colonel; Brereton, Lewis H., Lieutenant-Colonel; Soubiran, Robert, Major; Biddle, Chas. J., Captain; Buford, Edward, Captain; Hall, James Norman, Captain; Morton, Captain; Rockwell, Robert, Captain; Baer, Paul Frank, 1st Lieutenant; Cassady, Thomas G., 1st Lieutenant; Miller, C. L., 1st Lieutenant; Putnam, David, 1st Lieutenant; Tillman, F. A., 1st Lieutenant; Turner, G. W. Evans, 1st Lieutenant.

Croix De Guerre (With Gilt Star)

Burger, Valentine J., 2nd Lieutenant; Cassady, Thomas G., 1st Lieutenant; Coleman, Thomas F., 2nd Lieutenant; Conover, Harvey, 1st Lieutenant; Hill, Raymond C., 1st Lieutenant; MacCormick, Russel, 1st Lieutenant; McCormick, Russell C., 1st Lieutenant; Plummer, Charles W., 2nd Lieutenant; Ponder, William T., 1st Lieutenant; Rancourt, John I., 1st Lieutenant; Schauffler, William G., Major.

Croix De Guerre (With Silver Star)

Evans, Floyd E., 1st Lieutenant; Green, Adwin M., 1st Lieutenant; Green, Paul M., 1st Lieutenant; Merrill, Harold W., 1st Lieutenant; Rhodes, Carlyle, 1st Lieutenant.

Croix De Guerre (With Bronze Star)

Chambers, Reed, Captain; Grier, Alexander, 2nd Lieutenant; Hill, Robert E., 1st Lieutenant; Lindsey, Leon M., 1st Lieutenant; Llewellyn, Frank Albert, 1st Lieutenant; Noel, Roland Hall, 2nd Lieutenant; Noyes, Stephen H., 1st Lieutenant; Osgood, James, Captain; Rotharmel, Kennets, 2nd Lieutenant; Snook, Walter B., Captain; Thompson, Clifton, 2nd Lieutenant; Tompkins, Clarence B., 1st Lieutenant; Baker, James C., Sergeant.

Lieutenant; Dolan, Chas. H., Jr., 1st Lieutenant; Dugan, William E., 1st Lieutenant.

Italian Decorations

Gold Medal of Valor

Coleman, De Witt, 1st Lieutenant.

Silver Medal of Valor

Hartney, Harold E., Lieutenant-Colonel; Bahl, James L., 1st Lieutenant.

Officer of the Crown of Italy

Glendinning, Robert, Major.

Knight of the Crown of Italy

Fleishman, Charles M., Captain; Maquire, Frank H., Captain; Bongiorno, Philip, Captain; Spalding, Albert, 1st Lieutenant; Kiel, O. B., Captain (M. C.)

the Congressional Medal had been given to Lieutenant Talbot, and Gunnery Sergeant Robinson, attached to the First Marine Aviation Force in France.

X

GROUND COURSES AND FLYING SCHOOLS

(A) GROUND COURSES

COLLEGES, UNIVERSITIES AND SCHOOLS IN THE UNITED STATES, OFFERING PRACTICAL OR THEORETICAL COURSES IN AERONAUTICS

Name	*Address*
ACADEMY OF APPLIED AERONAUTICS	Irving Park Boulevard and Western Avenue, Chicago, Illinois.
CASTLE GIRLS SCHOOL	Tarrytown-on-Hudson, New York.
UNIVERSITY OF COLORADO	Boulder, Colorado.
KANSAS STATE AGRICULTURAL COLLEGE	Manhattan, Kansas.
MASSACHUSETTS INSTITUTE OF TECHNOLOGY	Boston, Massachusetts.
UNIVERSITY OF MICHIGAN	Ann Arbor, Michigan.
PENNSYLVANIA STATE COLLEGE	State College, Pennsylvania.
UNIVERSITY OF PENNSYLVANIA	Philadelphia, Pennsylvania.
PURDUE UNIVERSITY	Lafayette, Indiana.
THROOP COLLEGE OF TECHNOLOGY	Pasadena, California.
TUFTS COLLEGE	Tufts, Massachusetts.

COURSE CONTEMPLATED

GEORGIA SCHOOL OF TECHNOLOGY	Atlanta, Georgia.
UNIVERSITY OF ILLINOIS	Champlain, Illinois.
IOWA STATE COLLEGE	Ames, Iowa.
OHIO STATE UNIVERSITY	Columbus, Ohio.
STATE UNIVERSITY OF OKLAHOMA	Norman, Oklahoma.
OREGON AGRICULTURAL COLLEGE	Corvallis, Oregon.
SHEFFIELD SCIENTIFIC SCHOOL OF YALE	New Haven, Connecticut.

Name	*Address*
Dayton-Wright Airplane Company	Dayton, Ohio.
Gallaudet Aircraft Corporation	30 East 42nd Street, New York, N
Gallaudet Aviation School, Inc.	York.
East Greenwich, Rhode Island.	
Glenn L. Martin Company	Cleveland, Ohio.
West Virginia Aircraft Company	Wheeling, West Virginia.
Schools at Princeton, New Jersey, and Daytona, Florida.	

The Goodyear Tire & Rubber Company, Akron, Ohio, maintains a school f balloons and dirigibles.

XI
UNITED STATES AERIAL MAIL STATISTICS

(A) Performance and Cost
NEW YORK—WASHINGTON ROUTE

	MAY 15 TO SEPT. 30 1918	OCT. 1 TO DEC. 31 1918	JAN. 1 TO MAR. 31 1919	APR. 1 TO JUN. 30 1919	TOTALS AND AVERAGES 1918–19
[1] Total cost operation	$42,800.69	$33,815.90	$41,267.03	$42,304.70	$160,188.32
[2] Cost per mile, average	.64	[3] .93	[3] 1.25	.87	.87
Cost per ton-mile	....	....	....	....	....
Cost per flying hour	46.88	49.68	89.64	66.07	63.06
Cost per mile overhead	.18	.33	.42	.27	.28
Cost per mile, flying	.17	.19	.28	.20	.20
Cost per mile, mainte-					

[redacted]

	May 15 to May 31, 1919	June 1 to June 30, 1919	Totals and Averages
[1] Total cost operation	$7,514.15	$12,304.87	$19,819.02
Cost per mile, average	.71	.57	.61
Cost per ton-mile	....	....	....
Cost per flying hour	55.36	50.40	52.88
Cost per mile, overhead	.17	.17	.17
Cost per mile, flying	.21	.20	.20
Cost per mile, maintenance	.33	.20	.24
Pounds mail carried	9,933.	20.003.	29.936.
Miles flown	10,653.	21,689.	32,342.
Time in air	135h 44m	224h 55m	360h 39m
Average speed miles per hour	78.	96.	87.
Miles per gallon gasoline	2.89	2.22	2.56
Number trips possible	48.	51.	99.
Number trips made	46.	49.	95.
Per cent. performance	96.	96.	96.
Forced landings	0.	0.	0.
Mechanical troubles	0.	0.	0.
Weather	0.	0.	0.
Other causes	0.	0.	0.
Falls, total number	1.	0.	1.
Fatal	1.	0.	1.
Wounded	0.	0.	0.
Number planes operated	14.	16.	15.

[1] Costs include: Gas, Grease and Oil, Office Force, Operation of Motorcycles and Trucks; Rent, Light, Fuel, Power, Telephone and Water; Miscellaneous, Pilots, Mechanics and Helpers, Repairs and Accessories, Interest on Investment, Departmental Overhead Charge.

(B) Itemization of Costs

	New York-Washington				Cleveland-Chicago	
	From May 15, 1918 to Dec. 31, 1918		From May 15, 1918 to June 30, 1919		From May 15, 1919 to June 30, 1919	
	Total	Average per mile	Total	Average per mile	Total	Average per mile
Gasoline	$6,772.65	.066	$13,704.15	.074	$3,423.99	.105
Grease and oil	1,499.46	.014	3,284.19	.018	461.71	.014

[redacted]

Aerial Mail Pilots

Applications for appointment as aerial mail pilots may be made to the Seco Assistant Postmaster General, Mail Service, Post Office Department, Washingt District of Columbia.

Qualifications should be stated in detail with special reference to cross-count flying, aerial navigation, radio work and total number of hours' air experien Five hundred hours in the air are considered desirable. Each application shou be accompanied by three letters of recommendation from persons familiar wi the qualifications set forth.

Salaries are $2000 per annum, with automatic increases of $200 for eve additional 30 hours of flying up to and including the $2800 grade. Promotio up to and including the $3600 grade, will be based on special qualifications vealed in the pilot's service, such as unusually meritorious work, executive ability, exceptional knowledge of aerial navigation, skilfulness in radio telegraphy or telephony, aeronautical instrumentation, etc.

Aerial Postage Rates

The use of distinctive aerial mail stamps are no longer necessary and mail matter for despatch by airplane is treated in the same manner as other first-class mail and subject to the same rates of postage and conditions except that no article may be despatched by airplane which exceeds 30 inches in length and girth combined. Senders may arrange with postmasters to have letters despatched by aerial mail. The main function of the Aerial Mail Service is to advance the greatest quantities of mails between such selected points as may warrant the operation of this special service.

When the aerial mail was first established, special stamps were issued and the [redacted]

The National Advisory Committee for Aeronautics was appointed by the President, pursuant to act of Congress approved March 3rd, 1915 (naval appropriation act, public No. 273, Sixty-third Congress). Its membership consists of two officers of the Smithsonian Institution, the United States Weather Bureau, and the United States Bureau of Standards, together with five additional persons acquainted with the needs of aeronautical science, or skilled in aeronautical engineering or its allied sciences. All the members, as such, serve without compensation.

The duties of the committee, as provided by Congress, are to supervise and direct the scientific study of the problems of flight, with a view to their practical solution, and to determine the problems which should be experimentally attacked, and to discuss their solution and their application to practical questions.

Under the rules and regulations formulated by the committee and approved by the President, technical subcommittees have been established whose general duties are to aid in determining the problems in their respective branches of the aeronautical field to be scientifically attacked, bringing to bear the knowledge derived from experimental investigations conducted in all parts of the world, and to endeavor to coordinate the research and experimental work involved in the study of problems agreed upon. These subcommittees are composed in part of specially appointed representatives of the Army and Navy Air Services.

Under the law the committee holds itself at the service of any department or agency of the Government interested in aeronautics for the furnishing of information or assistance in regard to scientific or technical matters relating to aeronautics, and in particular for the investigation and study of problems in this field with a view to their practical solution.

The committee may also exercise its functions for any individual, firm, association, or corporation within the United States, provided that such individual, firm, association, or corporation defray the actual cost involved.

The committee directly conducts scientific research and experiment in aeronautics at its research laboratory and associated buildings at Langley Field, Virginia, a section of which has been set aside by the War Department for its use. A clear distinction exists between scientific research in aeronautics as conducted by the committee and engineering research or development as conducted by other

marks, as adopted by the Army Air Service, which are to be permanently displayed on the airdromes listed.

The list includes in particular:

(1) Army Flying Fields (active and inactive);
(2) Naval Air Stations;
(3) Aerial Mail Fields;
(4) Municipal Airdromes; and
(5) Commercial Airdromes.

AIRDROMES (PERMANENT AIRPLANE HARBORS) AND SEAPLANE STATIONS IN THE UNITED STATES AND DEPENDENCIES

	City	*Name of Field*	*Type*	*Remarks*
		ALABAMA (AL)		
63	**Montgomery**	**Taylor Field**	**Army**	
		ARIZONA (AR)		
49	Tucson		Municipal	
		ARKANSAS (ARK)		
	Lonoke	Eberts Field	Army	
		CALIFORNIA (CA)		
59	Redwood City	Redwood City Aviation School	Commercial	208 acres, near San Francisco
23	Riverside	March Field	Army	
92	Sacramento	Mather Field	Army	

[redacted]

	City	Name of Field	Type	Remarks
		FLORIDA (FLA) (*Continued*)		
	Miami	Marine Corps Field	Navy	
	Pensacola	Naval Air Station	Navy	*Seaplanes only*
		GEORGIA (GA)		
46	Americus	Souther Field	Army	
73	Macon	Fair Grounds	Municipal	Triangle shaped 1,000'
121	Waycross		Municipal	
		HAWAIIAN ISLES (HI)		
	Honolulu	Luke Field	Army	At Ford's Island
		IDAHO		
	Coeur d'Alene		Municipal	160 acres
		ILLINOIS		
32	Belleville	Scott Field	Army	2000' x 1200'
189	Chicago	Grant Park Field	Air Mail	60 acres; on Lake Shore Front
		Ashburn Field	Commercial	Ae. C. of Illinois

City	Name of Field	Type	Remarks
	MARYLAND (MD) (*Continued*)		
College Park	Air Mail Field	Post Office	50 acres. On B. & O. R. R., 7½ mi. N.E. Washington, D.C., Post Office
	MASSACHUSETTS (MS)		
Bedford	Curtiss Flying Field	Commercial	Curtiss Aero Corp'n.
Taunton	King Flying Field	Municipal	1288′ x 774′
	MICHIGAN (MI)		
21 Battle Creek	Camp Custer	Army	
31 Detroit		Municipal	5280′ x 2640′

	City	Name of Field	Type	Remarks
		NEW JERSEY (NJ) (*Continued*)		
107	Hasbrouk Heights	Witteman-Lewis Field	Commercial	800 acres, 1 x ⅞ mi. Witteman-Lewis Aircraft Corp.
54	Keyport	Aeromarine Field	Commercial	1800′ x 400′—Aeromarine Plane & Motor Co.
77	Newark	Heller Field	Air Mail	47 acres, 4 mi. NE of Post Office adjoining Golf Links

NEW YORK

(N for Western half of State and Y for Eastern half.)

(L for Long Island)

* Aerodromes situated on Long Island are listed under New York City and Long Island.

Y-52	Albany	Quentin Roosevelt Field	Municipal	300′ x 600′
	Lake Placid		Commercial	Excellent Field
N-30	Lockport	Curtiss Field	Commercial	
	Newdorp, Staten		Army	1230′ x 800′

	City	Name of Field	Type	Remarks
	Wantaugh	Lufberry Field	Commercial	600′ x 600′
	Rochester		Municipal	1800′ x 1800′. In preparati
		NORTH CAROLINA (NC)		
	Fayetteville	(Camp Bragg) Pope Field	Army	
		OHIO (O)		
1	Bryan	Air Mail Field	Post Office	
7	Cleveland	Woodland Hills Park	Municipal	1100′ x 500′. Used by A Mail service. 5 mi. SE of Cleveland Post Office
7	Cleveland	Glenn Martin Field	Commercial	L shaped 3000′ x 300′ E-W and 1300′ x 200′ N-S. 8 mi. NE of Cleveland

City	*Name of Field*	*Type*	*Remarks*
	PHILIPPINE ISLANDS (PI)		
Cavite	Aerial Coast Defense Station	Army	
	TENNESSEE (TN)		
Bristol		Municipal	
Millington	Park Field	Army	
	TEXAS (TX)		
Benbrook	Carruthers Field	Army	
Everman	Barron Field	Army	
Ft. Worth	Hicks Field	Army	
	Taliaferro Field	Army	
	TEXAS (TX) Continued		
Houston	Ellington Field	Army	
San Antonio	Kelly Field No. 2	Army	
Waco	Rich Field	Army	
Wichita Falls	Call Field	Army	
	VIRGINIA (VA)		
Hampton	Langley Field	Army	
	Naval Air Station	Navy	*Seaplanes only*

immediate establishment of a nation-wide system of aerial stations and terminals.

The numbers at the left-hand side of this landing field list are those which have been assigned by the Army Air Service in connection with the national system of city numbering; under this system all municipalities of 2,000 population or over have been assigned numbers in accordance with a definite geographical program. The work of numbering cities of all the states in the Union has not as yet been completed.

Every state is being given a letter symbol. Anniston, Alabama, is thus known to the air tourist as AL-72, and so on.

LANDING FIELDS

ALABAMA (AL)

No.	*City*	*Name of Field*	*Type*	*Remarks*

ARKANSAS (ARK)

No.	*City*	*Name of Field*	*Type*	*Remarks*
	Arkadelphia		Emergency	About 40 acre
	Batesville		Emergency	meadow
	Berryville		Emergency	
	Brinkley		Emergency	
	Buffalo Creek		Emergency	
	Danville		Emergency	
	Dardanelle		Emergency	
	DeWitt		Emergency	
	El Dorado		Emergency	
	Fayetteville	Race Track	Emergency	
	Forest City		Emergency	
	Fort Smith		Emergency	160 acre field; Country Club, Golf Course
	Harrison	Race Track	Emergency	
	Hazen			

No.	City	Name of Field	Type	Remarks
	Calexico		Emergency	
	Calipatria	Calipatria	Emergency	800′ x 1000′
	Chinese		Emergency	
	Chino		Emergency	900′ x 1500′
112	Chico		Emergency	
105	Colusa		Emergency	800′ x 2000′
20	Corona		Emergency	500′ x 1500′
	Cottonwood		Emergency	
	Daggett		Emergency	500′ x 700′
	Dominegoni		Emergency	1500′ x 2500′
3	El Centro		Emergency	
115	Eureka		Emergency	
	Fallbrook		Emergency	300′ x 900′
55	Fresno		Emergency	600′ x 1500′
	Gridley		Emergency	
	Hemet		Emergency	1000′ x 500′
15	Hollister		Emergency	1500′ x 3000′
	Lancaster		Emergency	1200′ x 700′;

No.	*City*	*Name of Field*	*Type*	*Remarks*
		GEORGIA (GA) (*Continued*)		
29	Canton		Emergency	
9	Columbus	Race Track	Emergency	
63	Cordale		Emergency	
	Cumberland Island		Emergency	Beach
37	Dawson		Emergency	
109	Douglas		Emergency	
	Ellaville		Emergency	1200′ x 1200′
90	Fitzgerald		Emergency	1500′ x 900′
60	Fort Valley		Emergency	Triangle shaped
	Gracewood		Emergency	
43	Griffin		Emergency	1200′ x 600′
	Helena		Emergency	
83	Hawkinsville		Emergency	1200′ x 750′
2	LaFayette		Emergency	
107	McRae		Emergency	
73	Macon	Camp Wheeler	Emergency	Parade Grounds
31	Marietta	C. C. Golf Links	Emergency	
61	Marshallville		Emergency	600′ x 1200′
98	Milliedgeville	Golf Course	Emergency	450′ x 1500′
62	Montezuma	Curtiss	Emergency	1200′ x 1500′
65	Moultrie	Golf Course	Emergency	1800′ x 750′
	Oglethorpe		Emergency	1200′ x 900′

No.	City	Name of Field	Type	Remarks
	Twin Lakes		Emergency	
		ILLINOIS (IL)		
118	Abington		Emergency	1500′ x 1800′
136	Aledo		Emergency	900′ x 400′
49	Alton		Emergency	5280′ x 300′
169	Aurora		Emergency	1200′ x 600′
	Avena		Emergency	5280′ x 2640′
	Beckemeyer		Emergency	Large
203	Belvidere		Emergency	80 acres
	Blandenville	Poor Farm	Emergency	80 acres
110	Bloomington	Country Club		
36	Breese	Race Track	Emergency	½ mile
	Brownstown		Emergency	1200′ x 900′
	Caberry		Emergency	500′ x 2500′
63	Carlinville		Emergency	1100′ x 1300′
37	Carlyle		Emergency	1200′ x 400′
62	Carrollton		Emergency	1200′ x 600′
7	Cartersville	Dr. Farrill	Emergency	600′ x 1200′
56	Casey		Emergency	1300′ x 1300′
	Cedar Point		Emergency	

No.	*City*	*Name of Field*	*Type*	*Remarks*
		ILLINOIS (*Continued*)		
	Goreville		Emergency	
	Gorham		Emergency	
	Greenup		Emergency	
51	Greenville		Emergency	1300′ x 1300′
	Harvel		Emergency	
103	Havana		Emergency	2500′ x 1500′
	Hettick		Emergency	1320′ x 1320′
44	Highland		Emergency	1200′ x 1000′
	Hinkley		Emergency	
54	Jerseyville		Emergency	1800′ x 2000′
158	Joliet		Emergency	
133	Kankakee	State Insane Asylum	Emergency	2000′ x 2000′
	Keenes		Emergency	
	Kempton		Emergency	700′ x 500′
149	La Salle		Emergency	800′ x 400′
	Le Harpe		Emergency	1400′ x 1400′
	Le Roy		Emergency	2000′ x 2000′
95	Lincoln		Emergency	1320′ x 1320′
59	Litchfield		Emergency	1300′ x 2000′
	Lora		Emergency	
106	Macomb		Emergency	600′ x 800′
	Malta		Emergency	1200′ x 1200′
76	Marshall		Emergency	40 acres
35	Mascoutah		Emergency	2000′ x 2000′
74	Matoon		Emergency	
156	Mendota		Emergency	1500′ x 1500′
	Meredosia		Emergency	1300′ x 600′
3	Metropolis		Emergency	
122	Monmouth		Emergency	80 acres near Country Club
97	Monticello		Emergency	1000′ x 1000′

No.	*City*	*Name of Field*	*Type*	*Remarks*
	Peoria	Fair Grounds	Emergency	3960′ long
	Percy		Emergency	1500′ x 900′; Alfalfa field
	Pierron		Emergency	1500′ x 400′
18	Pinkneyville		Emergency	1500′ x 800′
128	Pontiac	Poor Farm	Emergency	1800′ x 1800′
147	Princeton		Emergency	1800′ x 1800′
	Ramsey		Emergency	2000′ x 1200′
	Robinson		Emergency	600′ x 600′
202	Rockford	Drill Grounds	Emergency	2500′ x 2500′
145	Rock Island	Framing	Emergency	
[illegible]	[illegible]		[illegible]	[illegible]

INDIANA (IN) (*Continued*)

No.	*City*	*Name of Field*	*Type*	*Remarks*
	Fowler		Emergency	
74	Frankfort		Emergency	2000′ x 1500′
59	Indianapolis	Speedway		
	Hamilton		Emergency	
	Ireland		Emergency	1200′ x 600′
107	Knox	Scholling's Farm	Emergency	1800′ x 1800′
				3960′ x 2640′
81	Lafayette		Emergency	
95	Logansport		Emergency	450′ x 750′
7	Loogootee		Emergency	750′ x 900′
17	Mount Vernon		Emergency	
78	Muncie		Emergency	
	New Harmony		Emergency	750′ x 450′
	New Richmond		Emergency	1200′ x 3000′
5	Petersburg		Emergency	300′ x 900′
62	Richmond		Emergency	1200′ x 1200′
124	South Bend	Notre Dame University	Emergency	Meadow
	Schereville		Emergency	
38	Spencer		Emergency	
27	Sullivan		Emergency	7500′ x 1200′
42	Terre Haute		Emergency	1600′ x 800′

KANSAS (KS)

No.	*City*	*Name of Field*	*Type*	*Remarks*
72	Abiline		Emergency	
5	Arkansas City		Emergency	
98	Belleville		Emergency	800′ x 1500′; Oval
	Cottonwood Falls		Emergency	1300′ x 1300′
35	Dodge City		Emergency	1300′ x 1300′
58	Emporia		Emergency	
88	Fort Leaven-worth		Emergency	
23	Fredonia	Fair Grounds	Emergency	
84	Goodland		Emergency	2400′ x 2400′
	Hiawatha	Race Track	Emergency	700′ x 1000′ Good, oval, inside ½ mile track
46	Iola		Emergency	1700′ x 1400′

No.	*City*	*Name of Field*	*Type*	*Remarks*
		KENTUCKY (KY) (*Continued*)		
	Morganfield		Emergency	
	Paducah		Emergency	
	West Point	Godman Field	Emergency	
	Winge		Emergency	
		LOUISIANA (LA)		
	Alexandria	Camp Beauregard	Emergency	Army Post
	Baton Rouge		Emergency	
31	Crowley		Emergency	
	Harrisonburg		Emergency	
	Kinder		Emergency	
56	Lake Providence		Emergency	
	Matchitoches		Emergency	
6	Minden		Emergency	
32	Monroe		Emergency	
79	New Orleans	Race Track	Emergency	Oval
39	Opeloussas		Emergency	
2	Shreveport	Fair Grounds	Emergency	Race track
	Tallulah		Emergency	
		MAINE (ME)		
38	Augusta		Emergency	
34	Lewiston		Emergency	
82	Old Town	Bachelder's Field	Emergency	500' x 2000'
16	Portland		Emergency	
		MARYLAND (MD)		
27	Baltimore	Pimlico Race Track	Emergency	
	Baltimore	Clifton Park	Emergency	
	Camp Meade		Emergency	
	Chase		Emergency	
	Elk Mill		Emergency	2100' x 400' about 75 acres
40	Havre de Grace		Emergency	
18	Laurel		Emergency	
42	Northeast		Emergency	
	Sparrows Point		Emergency	
		MASSACHUSETTS (MS)		
	Ashburnham		Emergency	
	Boston	Franklin	Emergency	
	Beverly		Emergency	
	Boxford		Emergency	
	Cambridge		Emergency	
	Deerfield		Emergency	
	Essex	Race Track	Emergency	
	Falmouth		Emergency	
	Grafton		Emergency	
	Hamilton		Emergency	
	Hudson		Emergency	
	Marlboro		Emergency	

o.	City	Name of Field	Type	Remark
	New Bedford	Fort Redman	Emergency	Drillgroun 700′ x 600
	Northampton		Emergency	
	Newberryport		Emergency	
	Orange		Emergency	
	Pitsfield		Emergency	
	Princeton		Emergency	
	Readville	Race Track	Emergency	
	Springfield	Mollwaine	Emergency	2000′ x 200
	So. Framingham		Emergency	
	Upton		Emergency	
	Worcester	Race Track	Emergency	
	Weyland		Emergency	

MICHIGAN (MI)

1	Adrian		Emergency	
3	Albion	Finley	Emergency	250′ x 400′
	Almot		Emergency	700′ x 700′
5	Ann Arbor	University of Michigan	Emergency	1050′ x 750′

No.	City	Name of Field.	Type	Remarks
		MICHIGAN (MI) (*Continued*)		
	Lansing	McPherson Farm	Emergency	
	Lansing	Mich. Agricultural College	Emergency	
	Lansing	Race Track	Emergency	
71	Lapeer	County Farm Hospital	Emergency	1500′ x 1500′
19	Lawton		Emergency	
	Manchester	Spaferdy	Emergency	825′ x 1155′
	Mayville		Emergency	660′ x 960′
83	Midland		Emergency	
	Milea		Emergency	
82	Mount Pleasant	Cemetery	Emergency	
2	Niles		Emergency	
34	Plymouth		Emergency	
	Pointe aux		Emergency	
	Barques		Emergency	
	Redwood City		Emergency	1000′ x 400′
	Saint Charles		Emergency	
	Sandusky		Emergency	
	Standish	Fair Grounds	Emergency	
	Stockbridge		Emergency	300′ x 650′
	Wayne		Emergency	
	Yale		Emergency	
27	Ypsilanti			1000′ x 1000′; L-shaped
		MINNESOTA (M)		
46	Appleton		Emergency	Good
67	Breckenridge		Emergency	Good
	Cannon Junction		Emergency	Good
	Clare City		Emergency	Good
	Crow River		Emergency	Fairly good
	Daktoa		Emergency	
	Dresbach		Emergency	
78	Duluth	Superior Country Club	Emergency	300′ x 975′; golf links
4	Fairmont		Emergency	Good
40	Fort Snelling	Parade Grounds	Emergency	1200′ x 1200′
	Golden		Emergency	
	Graceville		Emergency	
37	Hastings		Emergency	
27	Lake City		Emergency	
	Maple		Emergency	
	Mayer		Emergency	
	Maynard		Emergency	
	Milan		Emergency	
	Minnesota City		Emergency	
43	Montevideo		Emergency	
	New Germany		Emergency	

No.	City	Name of Field	Type	Remarks
	Parker		Emergency	
	Pine Creek		Emergency	
33	Red Wing		Emergency	
49	Valley		Emergency	
28	Wabasha		Emergency	
	Wacona		Emergency	Good
	Wayzata		Emergency	
	Wheaton		Emergency	Good
	White Rock		Emergency	Good
47	Willmar		Emergency	Good
18	Winona		Emergency	1200′ x 600′

MISSISSIPPI (MP)

	Artesia		Emergency	
	Belzoni		Emergency	300′ x 1200′
	Biloxi		Emergency	300′ x 1200′
	Canton	Race Track	Emergency	
	Charleston		Emergency	3000′ x 900′
	Como		Emergency	

MISSOURI (MO) (*Continued*)

No.	*City*	*Name of Field*	*Type*	*Remarks*
119	Hamilton		Emergency	1500′ x 1500′
86	Higginsville		Emergency	1600′ x 800′
84	Independence		Emergency	1300′ x 1300′
	Ironton		Emergency	
69	Jefferson City		Emergency	
	Jonesboro		Emergency	1300′ x 1300′
83	Kansas City	Overland Park	Emergency	2000′ x 1100′
83	Kansas City	Swope Park	Emergency	1500′ x 500′
	Keota		Emergency	1200′ x 600′
	Leasburg		Emergency	1500′ x 1000′
36	Lebanon		Emergency	1300′ x 1300′
88	Marshall		Emergency	850′ x 850′
9	Monett		Emergency	
	Monroe City		Emergency	45 acre square field
	New Florence		Emergency	650′ x 1000′
	New Haven		Emergency	500′ x 100′
	New London		Emergency	
110	Paris		Emergency	3960′ x 2640′
5	Poplar Bluffs		Emergency	2000′ x 600′
	Richland		Emergency	3000′ x 2600′
42	Rollo		Emergency	2500′ x 2500′
53	Saint Genevieve		Emergency	
117	Saint Joseph		Emergency	
67	Sedalia	Fair Grounds	Emergency	900′ x 900′
	Senneca		Emergency	2000′ x 1000′

o.	City.	Name of Field	Type	Remarks
	Manhattan		Emergency	
	Miles City	Fort Keogh	Government	
	Mission		Emergency	
	Missoula		Emergency	1800′ x 1800′; L-shaped
	Missoula	Fort Missoula	Government	
	Missoula		Emergency	2000′ x 2000′; Good
	Paradise		Emergency	
	Park City		Emergency	
	Perma		Emergency	
	Plains		Emergency	
	Reid Point		Emergency	
	Thompson Falls		Emergency	1000′ x 1300′
	Townsend		Emergency	
	Winston		Emergency	
		NEBRASKA (NE)		
	Central City		Emergency	2000′ x 2000′
	Fort Crook	Parade Ground	Government	

No.	City	Name of Field	Type	Remarks
		NEW MEXICO (NM)		
	Albuquerque			Flying School
	Chapelle		Emergency	
	Carlsbad		Emergency	
	Clayton		Emergency	
	Columbus		Emergency	
	Des Moines		Emergency	
	Gallup		Emergency	
	Las Vegas		Emergency	
	Deming	Drill Grounds	Emergency	
	Lordsburg		Permanent	
	Onava		Emergency	
	Optimo		Emergency	
	Santa Fe		Emergency	
	Shoemaker		Emergency	
	Tucumcari		Emergency	
	Wagon Mound		Emergency	
		NEW YORK (N = Western half of State) (Y = Eastern half of State)		
	Au Sable Forks		Emergency	
L-8	Babylon, L. I.	H. J. Damm	Emergency	
Y-37	Binghamton	De Forest Street	Emergency	1200′ x 600′
	Birdsell		Emergency	300′ x 1200′
	Brooklyn	Parade Ground	Emergency	600′ x 1800′
N-19	Buffalo	Cranberry Lake	Emergency	
	Coney Island		Emergency	
N-7	Dunkirk		Emergency	
Y-33	Glen Falls		Emergency	
Y-22	Goshen		Emergency	
Y-43	Ithaca	Thomas Morse	Emergency	1200′ x 120′
	Jay		Emergency	
	Keeseville		Emergency	
	Liberty		Emergency	700′ x 1100′
Y-76	Little Falls	Smith's Field	Emergency	700′ x 700′; Excellent
	Lowville		Emergency	
	Millerton		Emergency	1800′ x 350′
	Montauk Point		Emergency	
Y-1	New York City	Gallatin No. 1	Emergency	
Y-71	Oneida	Oneida Aviation	Emergency	300′ x 60′
	Orchard		Emergency	
N-41	Oswego		Emergency	
	Pierce Field		Emergency	
Y-97	Plattsburg	Plattsburg Barracks	Emergency	Good
	Plum Island		Emergency	
Y-19	Port Jervis	Cuddebecks	Emergency	600′ x 500′
Y-32	Poughkeepsie	Poughkeepsie Race Track	Emergency	600′ x 150′

No.	*City*	*Name of Field*	*Type*	*Remarks*
	Pulaski		Emergency	
N-34	Rochester		Municipal	1800′ x 1800′; in preparation
Y-93	Saranac Lake		Emergency	
Y-63	Schenectady		Emergency	In Preparation
	Sheepshead Bay	Motordrome	Emergency	
	Silver Creek		Emergency	
Y-55	Syracuse	Bethka	Emergency	1200′ x 400′
Y-12	Tarrytown		Emergency	
	Union		Emergency	
Y-74	Utica	Utica Aviation	Emergency	1500′ x 900′
Y-54	Waterloo	Thomas	Emergency	600′ x 600′
N-6	Westfield		Emergency	
Y-6	Yonkers	Yonkers Golf Field	Emergency	300′ x 75′

No.	City	Name of Field	Type	Remarks
		OHIO (O)		
126	Akron	Portage Country Club	Emergency	
142	Bowling Green		Emergency	
	Cedar Point		Emergency	
1	Cincinnati	Phoenix Country Club	Emergency	
		Hamilton Country Club	Emergency	
127	Cleveland	Cleveland Aero Club	Emergency	
49	Columbus		Emergency	
66	Coshocton		Emergency	1200′ x 1800′
89	Lima		Emergency	450′ x 1500′
101	Mansfield		Emergency	1400′ x 800′
	Minerva		Emergency	1800′ x 1800′
58	Newark		Emergency	1400′ x 1400′
	New London		Emergency	2100′ x 1500′
63	Piqua		Emergency	
154	Sandusky		Emergency	
168	Toledo	Bay View Yacht Club	Emergency	1200′ x 1500′
		OKLAHOMA (OK)		
	Ada	Norr's Meadow	Emergency	300′ x 1000′
	Ardmore		Emergency	100 acres
	Atoka		Emergency	
	Blackwell	Race Track	Emergency	450′ x 1350′
	Blanchard	Davis Field	Emergency	1000′ x 500′
	Bristow		Emergency	
	Chandler	Rifle Range	Emergency	1800′ x 750′
	Chattanooga		Emergency	
	Cheyenne		Emergency	600′ x 1200′
	Chickasha		Emergency	
	Clarimore		Emergency	½ mile track
	Cleveland		Emergency	1200′ x 200′
	Clinton		Emergency	700′ x 250′
	Cordell	Moslander	Emergency	½ mile x ¼ mile
	Cranfield		Emergency	
	Cushing		Emergency	

No.	City	Name of Field	Type	Remarks
	Henryetta	West Henryetta Field	Emergency	80 acres 2640′ x 1320′
	Hobart	Raymond Goodson Landing	Emergency	4000′ x 600′
	Holdenville	Race Track	Emergency	1320′ x 1320′
	Hugo		Emergency	
	Kingfisher		Emergency	225′ x 900′
	Lexington		Emergency	
	McAlester	Fair Ground	Emergency	
	McLoud	McCray	Emergency	600′ x 100′
	Macomb		Emergency	1200′ x 1200′
	Mangum	Boggs	Emergency	300′ x 600′
	Marlow		Emergency	
	Mountain Park		Emergency	050′ x 225′
	Muskogee	Fair Grounds	Emergency	1800′ x 800′
	Newkirk	Ward's Pasture	Emergency	160 acres
	Norman	Smith Pasture	Emergency	2500′ x 1500′

No.	City	Name of Field	Type	Remarks
		OREGON (ORE) (*Continued*)		
	Cottage Grove		Emergency	
	Dallas	Lacreole Landing	Emergency	450' x 890'
	Corvallis		Emergency	
	Eugene	Eugene Landing	Emergency	1500' x 2000'; Good
	Grant's Pass	Grant's Pass Aviation	Emergency	660' x 2640'
	Grenada		Emergency	
	Imbeler		Emergency	2600' x 2500'
	Medford		Emergency	
	Penleton		Emergency	600' x 2000'
	Portland	Eastmoreland	Emergency	1500' x 200'
	Roseburg		Emergency	
	Salem		Emergency	
	The Dalles		Emergency	800' x 1500'
		PENNSYLVANIA (P)		
58	Altoona	Driving Park and Fair Grounds	Emergency	Half-mile track
37	Chester		Emergency	
141	Clearfield	Race Track	Emergency	One-half mile
142	Du Bois	Beaver Meadows	Emergency	450' x 1200'
125	Easton		Emergency	1800' x 800'
	Everett		Emergency	2000' x 1000'
29	Gettysburg		Emergency	
53	Harrisburg		Emergency	
83	Johnstown		Emergency	2000' x 2000'
57	Huntingdon		Emergency	
50	Lebanon		Emergency	1200' x 1200'
56	Lewistown	Race Track	Emergency	
	Ligonier		Emergency	
51	Middletown		Government	
	Milford		Emergency	
	Mount Union		Emergency	2100' x 600'
	Penllyn	Penllyn Polo	Emergency	300' x 1200'
40	Philadelphia	Speedway Flying	Emergency	1000' x 300'
	Philadelphia		Government	
11	Pittsburgh		Emergency	Golf Course
49	Reading		Emergency	1500' x 1500'
	Rodring Springs		Emergency	1200' x 900'
	Scranton	Clark's Summit	Municipal	
130	Stroudsburg		Emergency	
20	Uniontown	Race Track	Emergency	One mile
163	WilkesBarre	Suburban Park	Emergency	
		RHODE ISLAND (RI)		
16	Apponaug		Emergency	Good
	Bradford		Emergency	
	Collingwood	Race Track	Emergency	
12	East Greenwich		Emergency	

No.	City	Name of Field	Type	Remarks
2	Narragansett Bay	Naval Air Station	Government	Projected
7	Newport	Polo Club	Emergency	
27	Providence	Race Track	Emergency	Good
	Shannock		Emergency	
	Slocum		Emergency	
	Weed River Junction		Emergency	
42	Woonsocket	Race Track	Emergency	300′ x 1200′
		SOUTH CAROLINA (SC)		
	Aiken	Race Track	Emergency	One mile
	Sumter		Emergency	
	Bamberg		Emergency	
	Tillman		Emergency	
	Bennettsville	Bennettsville Flying	Emergency	1800′ x 525′; L-shaped

o.	City	Name of Field	Type	Remarks
		TENNESSEE (TN) (*Continued*)		
	Nashville	E. L. Hampton	Emergency	2000′ x 4000′
	Nashville	Reedy	Emergency	82 acres (Mr. Bush)
	Somerville		Emergency	1000′ x 3000′
	Sugar Tree		Emergency	
	Union City	Race Track	Emergency	1050′ x 225′
	Woodbury		Emergency	500′ x 2000′
		TEXAS (TX)		
	Abott		Emergency	
	Alpine		Emergency	Very good; quadrant shaped
	Austin	Penn	Emergency	
	Barstow		Emergency	Fairly good
	Beaumont		Emergency	500′ x 900′; ½ mile west of the heart of city
	Beeville		Emergency	Exceptionally fine field
	Belcherville		Emergency	Very smooth
	Benchley		Emergency	
	Big Springs		Emergency	Marked by white circle
	Bonham		Emergency	
	Bowie		Emergency	
	Brownwood		Emergency	
	Bryan	College Station	Emergency	1000′ x 1500′
	Cactus		Emergency	L-shaped
	Cameron		Emergency	3000′ x 8000′

'o.	City	Name of Field	Type	Remar
	Eagle Lake		Emergency	
	Electra		Emergency	
	El Paso	Ft. Bliss Parade Ground	Emergency	
	Fairbanks		Emergency	
	Flatonia		Emergency	
	Ft. Clark	Parade Ground	Emergency	
	Ft. Stockton	Drill and Parade Ground	Emergency	
	Fredericksburg		Emergency	
	Gainsville		Emergency	Rectangul
	Galveston	Ft. Crockett Parade Grounds	Emergency	
	Giddings		Emergency	
	Haskell		Emergency	Good
	Hempstead		Emergency	Very good
	Henrietta		Emergency	
	Hollis		Emergency	
	Hondo		Emergency	1200′ x 800′; Very good
	Hot Wells		Emergency	

TEXAS (TX) (*Continued*)

No.	*City*	*Name of Field*	*Type*	*Remarks*
	Paris		Emergency	
	Pearland		Emergency	
	Pecass-2		Emergency	
	Port Arthur	Naval Air Station	Emergency	Navy Balloon Fld.
	Quannah		Emergency	
	Ringold		Emergency	
	St. Joe		Emergency	
	Saltillo		Emergency	
	San Angelo	Penrose B. Metcalfe	Emergency	2500' x 2500'
	San Antonio	Brooks	Government	Army Balloon Fld.
	San Marcos		Emergency	
	Seymour		Emergency	
	Sherman		Emergency	
	Shumld		Emergency	
	Sierra Blanca		Emergency	Unlimited space
	South Houston	San Leon	Emergency	Near Ellington Fld.
	Spoffard		Emergency	Very good
	Stanford		Emergency	
	Stanton		Emergency	Excellent
	Sulphur Springs		Emergency	200 acres
	Sweetwater		Emergency	320 Acres; Rectangular in shape
	Temple		Emergency	
	Texarkana	Country Club	Emergency	50 acres
	Texarkana		Emergency	75 acres
	Texline		Emergency	
	Thorndale		Emergency	
	Toyah		Emergency	
	Tyler		Emergency	½ mile track
	Uvalie		Emergency	1000' long; L-shaped
	Van Horne		Emergency	
	Vernon		Emergency	
	Victoria		Emergency	2500' x 2500'
	Washburn		Emergency	Large
	Waxahachie		Emergency	
	Wellington		Emergency	
	Wharton		Emergency	
	Whitesboro		Emergency	

UTAH (U)

No.	*City*	*Name of Field*	*Type*	*Remarks*
U-46	Salt Lake City		Emergency	
U-52	Ogden		Emergency	
U-64	Salduro		Emergency	
2	Bennington		Emergency	

No.	City	Name of Field	Type	Remarks
		VERMONT (VT)		
2	Bennington		Emergency	
52	Montpelier	Race Track	Emergency	
17	Windsor		Emergency	1800′ x 400′; Marked "T"
		VIRGINIA (VA)		
	Blacksburg		Emergency	1600′ x 700′
4	Franklin		Emergency	Very good; 2(x 300 yds.
8	Lawrenceville		Emergency	
37	Lynchburg	Y. M. C. A. Island	Emergency	700′ x 150′
22	Norfolk	Parade Grounds	Emergency	
	Oldfield		Emergency	
29	Petersburg		Emergency	1880′ x 800′; Triangle
41	Richmond	Fair Grounds	Emergency	At Fulton, suburb of Richmond; 2 miles by ½ mile
	Riverton		Emergency	

No.	City	Name of Field	Type	Remarks
		WISCONSIN (W) (Continued)		
	Milwaukee	Milwaukee Air Port	Emergency	Excellent
	North Cross		Emergency	
31	Oconomowoc		Emergency	Good
	Pepin		Emergency	Excellent
	Purdy		Emergency	Fairly good
	Quincy		Emergency	Good
	Spring Green		Emergency	Excellent
	Stockholm		Emergency	Good
22	Waukesha		Emergency	Large fld. east of city
	Waukesha		Emergency	Large L-shaped one mile west of city; excellent
		WASHINGTON (WSH)		
	Bellingham	Municipal Golf Links	Emergency	
	Chehalis		Emergency	Good 2000′ x 2000′
	Ellensburg		Emergency	Good 1500′ x 1800′
	Greenacres		Emergency	Good
	Irvin		Emergency	Good
	Millwood		Emergency	Good
	Opportunity		Emergency	Good
	Parkwater		Emergency	Good
	Pasco		Emergency	1500′ x 4000′
	Ritzville		Emergency	1000′ x 2000′
	Seattle	Municipal Golf Links	Emergency	250′ x 2500
	Tacoma	Speedway	Emergency	Oval enclosed by 7 mile track
	Walla Walla		Emergency	4000 x 3000′
	Yakima		Emergency	2000′ x 2500′

WYOMING (WY)

XV
AIRCRAFT INSURANCE

Through the failure of the United States Government to formulate a defini policy with regard to aeronautical development, the establishment of landi fields, the inspection of aircraft, and the licensing of pilots, the writing of ai craft insurance in this country has been very seriously embarrassed.

At the present the following kinds of insurance are written:

Fire (Floater form);

Collision (Meaning damage to plane);

Liability (Meaning injury to individuals other than passengers);

Property Damage (Meaning damage to property other than the plane);

Life and Accident Insurance for passengers in aircraft, covering specific flights.

The above forms of insurance are written by two classes of companies; one group known as casualty companies and the other as fire companies. There are seven American companies in the so-called fire group writing various forms of aviation insurance, and two in the casualty group. One of the casualty companies is in position to write what is called full coverage, covering fire, collision, property damage and public liability, also accident and life insurance.

Writers of aircraft insurance are of the opinion that a fair system of rates and an adequate extension of insurance protection can not be brought about until the Federal Government accepts the responsibility with which it is confronted by proper supervision of pilots, establishment of adequate landing fields, elimin